4436

Instruction Manual

Noise Dose Meter Type 4436

A sophisticated noise dose meter, designed to meet a wide range of standards – it has forty fixed set-ups and a user-definable set-up. These set-ups also make the instrument easy to use – it takes just a few moments for you to change the instrument's measurement parameters. The Type 4436 offers six noise dose and six noise level parameters, ensuring a comprehensive assessment of the noise exposure levels experienced by workers. The instrument's protected microphone enhances the resilience of the instrument. The Type 4436 simultaneously performs Peak (C) and RMS (A) measurements, relieving you of the need to make such measurements separately, thus saving you time and increasing the accuracy of your results.

Brüel & Kjær

ERRATA

Noise Dose Meter Type 4436
Instruction Manual (BE 1137–11), September 1991

Please note the following corrections

- Section 11.3, page 92. The lowermost formula should be as follows:

$$L_{EP,d} = 90.0 + 10 \log_{10} \frac{14\,400}{28\,800} = 90 - 3 = 87 \text{ dB}$$

- Section 11.3, page 93. The formula should be as follows:

$$Pa^2h = \int_0^T p_A^2(t)\, dt$$

where,

$p_A^2(t)$ is the square of instantaneous A-frequency weighted sound pressure as a function of time, t, for an integration time period equal to the actual measurement time.

- Section 11.4, page 94. The formula should be as follows:

$$PSEL = L_{Aeq,T} + 10 \log_{10} \frac{T}{T_0}$$

September 1991

Noise Dose Meter
Type 4436

From serial no. 1628681

September 1991

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Noise Dose Meter — Type 4436

FEATURES:

- Powerful
- Easy to Use
- Sturdy

USES:

- Evaluating personal noise exposure
- Assessing area noise in the workplace
- Serving as Type 2 Sound Level Meter (IEC 804 and IEC 651)

Powerful

A wide range of standards
The Type 4436 satisfies a wide range of noise exposure standards (see Specifications). It calculates, amongst other parameters, the Sound Exposure (Pa^2h) and the Daily Personal Noise Exposure Level ($L_{EP,d}$) – parameters recommended by recent, influential standards.

The Type 4436 has 40 fixed setups. Each contains a set of six measurement parameters, whose settings are variable (see Fig. 2). When you choose a setup, the Type 4436 will work in accordance with the parameters contained in that setup. You can easily change from one setup to another. A user setup lets you choose a combination of parameters not covered by any of the other setups.

Statistics and Time History
The Type 4436 calculates the SPL and L_{eq} every second (sampling rate: 16 times a second). From these calculations, the Type 4436 works out the Distribution and Cumulative Distribution of recorded noise levels, and also produces a Time History of your measurement results.

The Distribution and Cumulative Distribution are measured in 1 dB intervals, and can be viewed in either 1 dB or 5 dB intervals. With the Time History, the Type 4436 presents the 1-minute L_{eq}, MaxL and MaxP values, which can be viewed in 1-minute or 10-minute intervals.

Digital Output
The Type 4436 retains measurement data, even when turned off. You can transfer that data to a printer or personal computer.

Fig. 1 Noise Dose Meter Type 4436 measuring Personal Noise Exposure (instrument normally worn inside pocket), and the instrument itself

Setup Number	1	2	3	4	5	6	7	8	9	10
Microphone	Int.	Int.	Int.	Int.	Int.	Int.	Int.	Int.	Int.	Int.
Time Weighting	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Slow
Peak Filter	Lin.	Lin.	Lin.	Lin.	Lin.	Lin.	Lin.	Lin.	Lin.	Lin.
8 h 100% Level dB	85	90	85	90	90	90	84	85	90	90
Threshold dB	off	off	75	75	80	off	80	off	80	90
Exchange Rate	3	3	3	3	3	4	4	5	5	5

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Fig. 2 Setup numbers 1 to 10 (11 to 20, Time Weighting is Fast; 21 to 30, Microphone is External; 31 to 40, Time Weighting is Fast and Microphone is External)B

For print-outs, Brüel & Kjær's Graphics Printer Type 2318 is especially suitable, though ordinary RS–232–C serial printers can also be used. The Type 2318 produces informative graphs and tables of the Type 4436's Status, a Time History of measurement results, and Statistical Information (Distribution and Cumulative Distribution). Figs. 3, 4 and 5 show examples of such print-outs, and also illustrate what information is of-

fered by the Statistics, Time History and Status functions.

With a PC, you have three output modes: PC Transfer, PC DATA LOG and PC Dump. PC Transfer sends the Status, Time History and Statistics to an appropriate communications program. With PC DATA LOG, the 1-second L_{eq}, MaxL and MaxP values are sent to a PC, where they are processed by Application Software Type 7636, which records noise events, creates noise event reports and hourly noise reports, and can transfer such data to other program packages. With PC Dump, Application Software BZ 7028 accepts the Type 4436's data wholesale, processes it, and produces informative tables and graphs of the Status, Time History and Statistics.

A choice of microphones

The Type 4436's internal microphone (¼-inch, prepolarized), serves most measurement purposes, with a level range of 55 to 140 dB (A) and 90 to 143 dB (Peak). When Preamplifier Type 2642 and Prepolarized Microphone Type 4129 are used, the measurement floor of the noise dose meter is shifted downwards to 40 dB.

Sound Level Meter (SLM)

The Type 4436 is both a noise dose meter and a SLM, and fulfils, where relevant, IEC 804 (Integrating SLM Type 2) and IEC 651 (SLMs Type 2). The "SLM" display shows the SPL (A) and Peak (A or Lin.). While you use the SLM function, all other parameters are calculated as usual. A supplied SLM Adaptor lets you make hand-held measurements. Portable Tripod UA 0801 can be connected to the adaptor when you measure area noise exposure levels.

Easy to use

Handy setups

Getting from one setup to another is simple, yet changes, at a stroke, the combination of parameters upon which measurement calculations are based. The instrument, even when off, retains a chosen setup until you choose another. The display constantly reminds you what setup you are using. See Fig. 6.

Calibration

Calibration should be performed with Brüel & Kjær's Sound Level Calibrator Type 4230 or Multifunction Acoustic Calibrator Type 4226. Once the calibration procedure is started, it continues automatically. See Fig. 6.

Simultaneous RMS and Peak

The Type 4436's two detectors simultaneously measure RMS and Peak. This saves time – no need to measure RMS and then measure Peak. It also

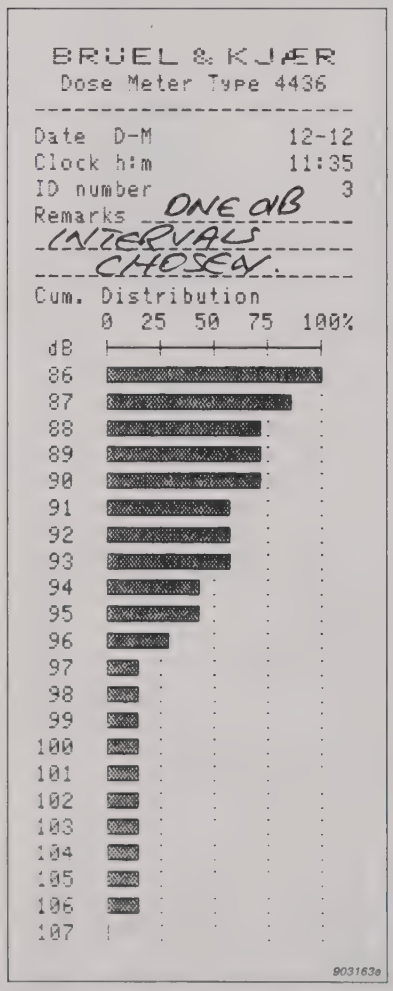

Fig. 3 Example print-out of Cumulative Distribution

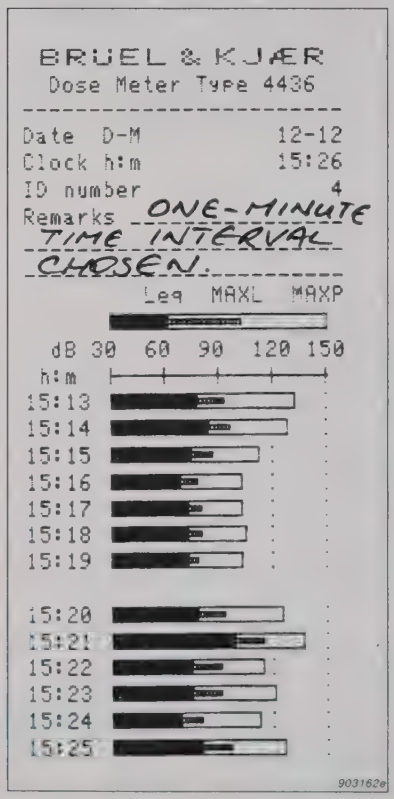

Fig. 4 Example print-out of Time History

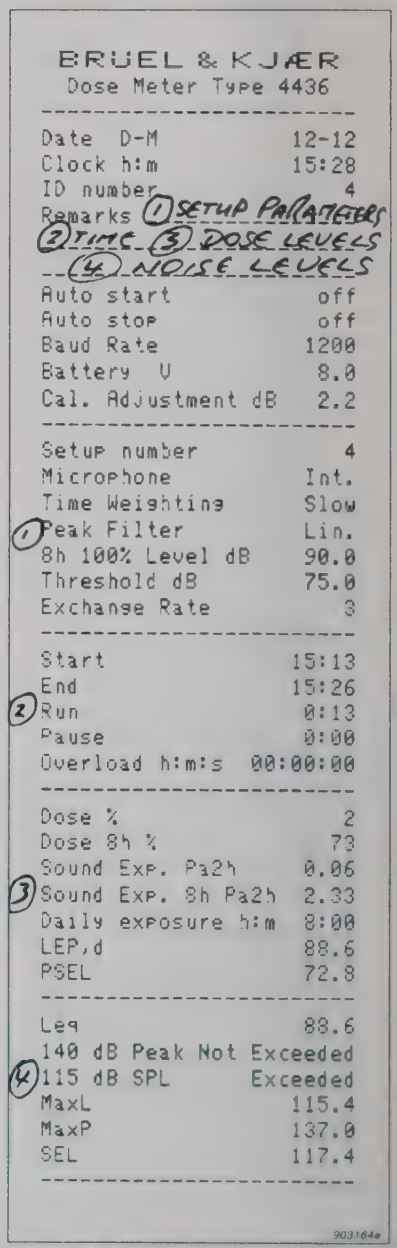

Fig. 5 Example print-out of Status

means that RMS and Peak measurements, and all related values, stem from the same sound signals.

Looking at Results

You can view results after measurements or during them (without disturbing measurements). This is true whether you read the results from the display, print them or send them to a computer.

Sturdy

Protected Microphone

With most noise dose meters, the microphone is exposed, and thus vulnerable to the hazards common in the workplace. Replacing damaged microphones wastes much time and money.

However, the Type 4436's microphone is protected inside the instrument's casing, where the hazards of the workplace cannot reach it. A strong, flexible rubber tube, attached to the Type 4436, guides sounds to the microphone. The Type 4436's design ensures that the sensitivity and fidelity of the microphone system accords to Brüel & Kjær's high standards.

Built to last

The body of the Type 4436 is made of a tough and lasting polycarbonate resin. It is well-sealed, and its curved edges make the instrument both sturdy and comfortable to wear.

Protecting Measurements

The Type 4436's pushkeys can be disabled, ensuring that accidental pushes of the keys will not corrupt ongoing measurements. The keys can be reactivated by entering a code ("4436").

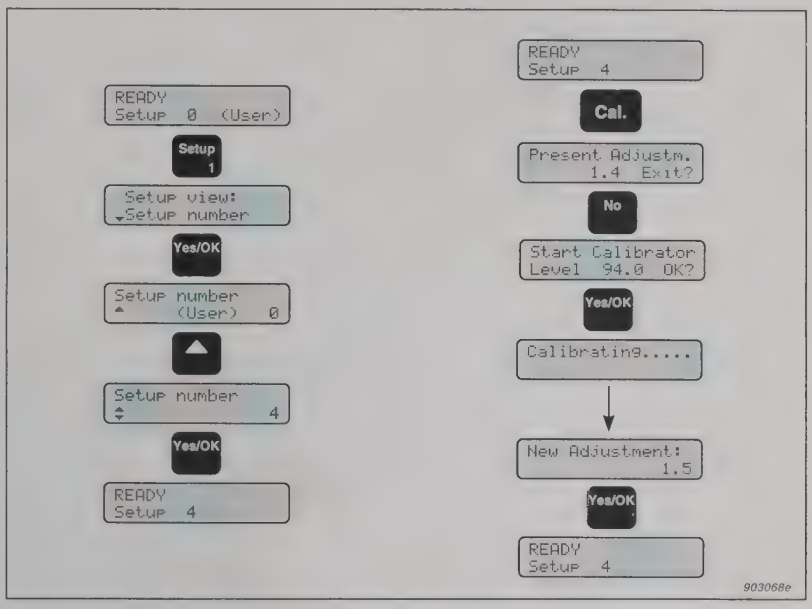

Fig. 6 Pushkey sequences for changing Setup and for Calibration

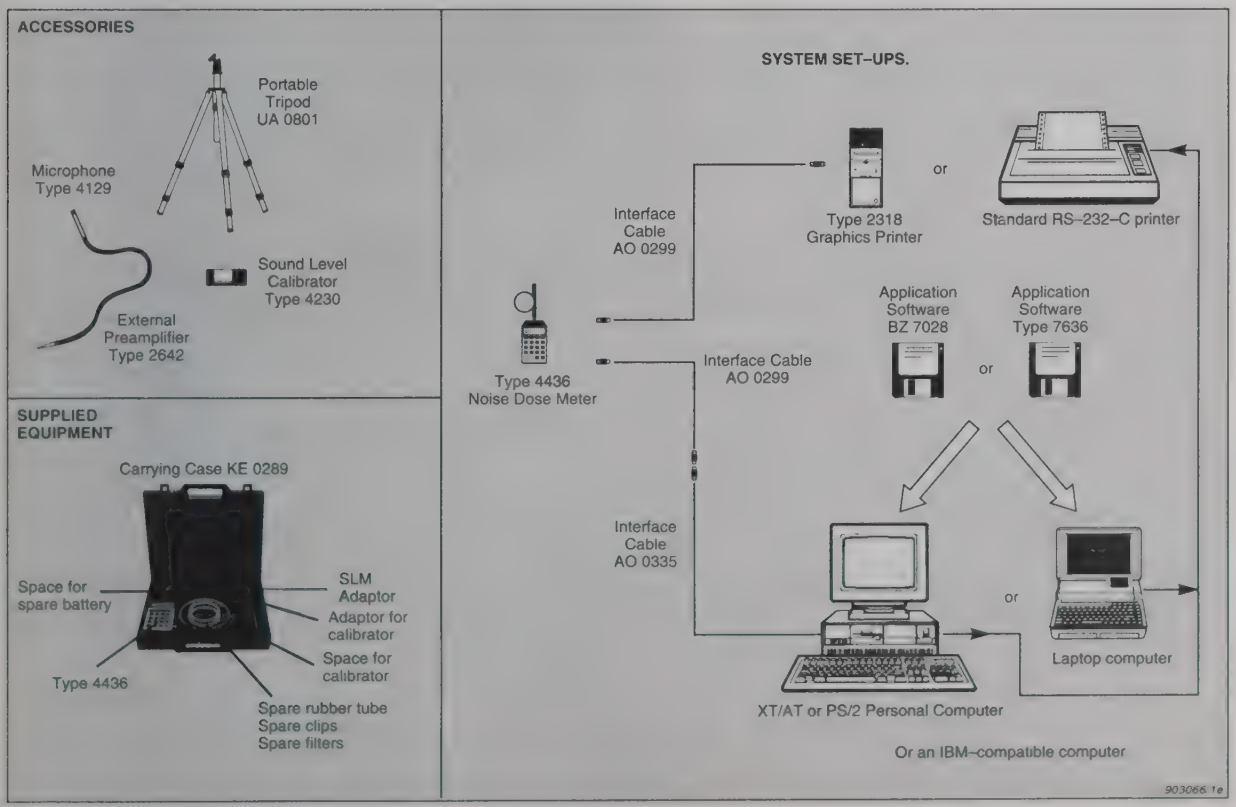

Fig. 7. System set-ups, with accessories

Specifications Type 4436

STANDARDS SATISFIED BY TYPE 4436:
EEC Directive 86/188/EEC; BS 6402:1983; Draft IEC Standard; ANSI S1.25 Draft 1986; IEC 651; IEC 804 1985; ANSI S1.43 1986; OSHA and DoD Requirements

MICROPHONE:
Internal: 1/4-inch prepolarized condenser microphone, set within the instrument – 70 cm rubber tube conveys sounds to microphone
External: 5-pin socket for Preamplifier Type 2642, with Prepolarized Microphone Type 4129 (both to be ordered separately)

RANGES AND WEIGHTINGS:
Frequency range: 20 Hz to 8 kHz
Dynamic range (internal microphone):
55 dB noise floor to 140 dB(A) (SPL)
90 to 143 dB (Peak)
(With external microphone, 40 to 125 dB(A) (SPL) and 80 to 128 dB (Peak))
Frequency weighting (filter):
Peak – A or Lin. weighting
L_{eq} and SPL – A weighting
Time weighting (detectors):
SPL – Slow or Fast; **Peak** – 100 μs
RMS and Peak are measured simultaneously

SAMPLING RATE:
16 times per second for SPL and L_{eq}

CALIBRATION:
Calibration, once started, is automatic

SETUP:
Microphone: Internal or External
Time weighting (SPL): Slow or Fast
Filter (Peak): A or Lin.
Threshold values: off, 75, 80, 85 or 90 dB
100% 8h levels: 80, 84, 85 or 90 dB
Exchange rate (q): 3, 4 or 5
Setup numbers:
0: User chooses setup parameters
1–40: Standard combinations of parameters

DOSE AND LEVEL DISPLAYS:
Dose displays:
Dose % and 8h Dose %: 0.00% to 9999%
Sound Exposure and 8h Sound Exposure: 0.00 Pa^2h to 99.99 Pa^2h

$L_{EP,d}$ and PSEL: 0.1 dB resolution
Level displays: 140 dB (Peak) and 115 dB (SPL) exceeded; MaxL; MaxP; $L_{eq}(L_{av})$; SEL; Overload; Overload Duration

DISTRIBUTION/CUMULATIVE DISTRIBUTION:
Measured in 1 dB intervals
Displayed in 1 dB or 5 dB intervals

TIME HISTORY (Digital output only):
One-minute $L_{eq}(L_{av})$, MaxL, MaxP values

SOUND LEVEL METER (0.1 dB resolution):
IEC classification: Type 2
SPL/Peak (max.) displayed each second
Adaptor for hand-held/tripod operation

AUTOMATIC START/STOP:
Presets Start and Stop times of measurement

PUSHKEYS:
20 keys, membrane type

DISPLAY (liquid crystal):
2 lines, 16 alphanumeric character spaces in each line each consisting of 5 × 8 dot matrix

CLOCK:
Accuracy better than one minute per 24 hours
Displayed times:
Current: hours : minutes day - month
Measurement: start, end, duration, pause, overload

MEMORY:Capacity:
All data recorded during battery life
'Constant Memory': When off, Type 4436 retains setup/measurement data (if battery flat or removed, data retained for at least 1 hour)

USING WITH PRINTER/COMPUTER (RS-232-C):
Output: 5-pin socket with ±5 V signal
Baud rates: 300, 1200, 2400, 4800 and 9600
Handshake: Ready/Busy hardwire
Transfer to printer (text and graphics):
To Graphics Printer Type 2318 or standard RS-232-C printer
3 output formats – Status, History, Statistics
Transfer to computer (IBM*-compatible):
3 output formats as given in table

Mode	PC Transfer (BK-LINK)	PC DATA LOG (Type 7636)	PC Dump (BZ 7028)
Active during measurement?	Yes (9600 Baud)	Yes (dose meas. suspended)	No
Transfer rate (Baud)	Up to 9600	9600	9600
Transferred data	All stored data	1 s L_{eq}, MaxL & MaxP	All stored data

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Optional application program BZ 7028:
Level Stripchart; Level/Cumulative Distributions (Table/Graphics); Time History (can be edited); combine several measurement files

ELECTROMAGNETIC COMPATIBILITY:
Complies with Class B of the American FCC (Federal Communications Commission) rules

ENVIRONMENT:
Humidity: 0% to 90% relative humidity
Temperature:
Operating: –10° to +50° C (14° to 122° F)
Storage: –20° to +70° C (–4° to 158° F)
(with batteries removed)
Magnetic field: unaffected at 100 A/m
Vibration: 90 dB max. at 480 Hz and 1 m/s^2
Warm-up time: 20 seconds max.

BATTERY:
9 V alkaline battery – IEC 6LF22 or 6LR61
Life of battery: At least 20 hours at 23° C (73° F); at least 8 hours at –5° C (23° F)
Life indicator: Displays battery voltage and estimate, in hours, of its remaining life
Warnings: 'Battery low' and 'Battery flat' Battery flat, Type 4436 turns off automatically

PHYSICAL:
Bodywork: Polycarbonate
Dimensions: 137 × 79 × 22 mm
(5.4 × 3.1 × 0.87 in)
Weight: 250 g (8.8 oz) with battery

Ordering Information

Type 4436: Noise Dose Meter
Includes following accessories:
DE 0056: 1/4-inch Adaptor for Type 4230
AF 0119: Spare Rubber Tube
UA 1135: 2 × Clips for Rubber Tube
DD 0456: 5 × Filters for Rubber Tube
FE 0035: 8 × Dustcaps for LEMO Sockets
DP 0769: SLM Adaptor
KE 0289: Carrying Case
DS 0823: Moulded Inlay for Case
QB 0016: 2 × 9.0 V Alkaline Batteries

Optional Accessories

FOR CALIBRATION:
Type 4230: Sound Level Calibrator
Type 4226: Multifunction Acoustic Calibrator

FOR USE WITH EXTERNAL MICROPHONE:
Type 2642: Preamplifier
Type 4129: 1/2-inch Prepolarized Microphone

FOR PRINTING MEASUREMENT DATA:
Type 2318: Graphics Printer
AO 0299: Serial Interface Cable

FOR USE WITH A COMPUTER:
Olivetti† M211 Laptop Computer or IBM* XT, AT or PS/2 Personal Computer or IBM*-compatible PC (DOS version: 3.0 or later)
AO 0335: RS-232-C Serial Interface Cable
AO 0299: Serial Interface Cable
Type 7636: Application Software for Statistical Noise Level Analysis

BZ 7028: Application Software for Noise Dose Meter Type 4436 (only PS/2 computer (EGA and 286 cpu) or Olivetti† M211 Laptop)
"PC Transfer" needs suitable communications program (eg BK-LINK)

FOR ASSESSING AREA NOISE:
UA 0801: Portable Tripod

* IBM is a trademark of the International Business Machines Corporation.

† Olivetti is a trademark of Ing. C. Olivetti & Co., S.p.A.

2. BEFORE YOU START

2.1. ABOUT THIS MANUAL

2.1.1. The Structure of the Manual

To make and store measurements with the Type 4436, all you have to do is the following:

1. **Switch the instrument on by pressing the "On/Off" pushkey.**

2. **Press the pushkey marked "Run".**

3. **Switch the instrument off when your measurements are finished, by pressing the "On/Off" pushkey.**

While the instrument is in the **Run** mode, it is receiving sound signals, calculating various noise parameters, and storing them as results – noise dose values, noise levels, statistics, amongst others. It retains this data even when you switch the instrument off.

The above procedure typifies the ease with which you can use the Type 4436 Noise Dose Meter's wide range of facilities, which this Manual helps you to use and understand. The Manual also shows you how to adapt the instrument for special applications – e.g. when you use it with a tripod – and how to make the most of your results by transferring them to a printer or computer. The latter stages of the Manual describe how to take care of the instrument, and deal with aspects of the Type 4436 which, though not vital to operation, help you better understand the instrument.

Each chapter deals with a particular aspect of the instrument, and most have a short introduction. If you are in doubt about any terminology, refer to chapter 11. Also, please bear in mind that the Contents list and the Index are a great help when you want to locate particular information.

2.1.2. Illustrations and Text

An initial look through the Manual will reveal that there are quite a number of illustrations which demonstrate specific procedures. Fig. 2.1 is an example. These illustrations comprise drawings of the displays and of the pushkeys which give you access to those displays. Arrows lead you onto the next step in a procedure. In some cases, there is explanatory text beside the drawings. This text refers to a particular display or contains more general information about the procedure in question. The procedure contained in each illustration is also described, step by step, in the main text of the manual.

The Manual often refers to keys, modes, functions, options and displays. In order to differentiate these, we have used different types of text, as follows:

- The Type 4436's arrow pushkeys: ▼ and ▲
- All the other pushkeys: **"On/Off"** or **"SLM"**
- Modes: **READY**, **RUN**, **PAUSE**
- Functions and options: **Auto.** or **Distribution**
- Text on the Type 4436's display: **Unstable calibrator level**
- Computer keys: <**Break**> and <**F10**> etc.

2.2. A TRIAL RUN

Before we start going into the details of how you use the instrument, we shall run through a few of the Type 4436's procedures. This will give you a feel for the instrument, and introduce you to its working principles. Each of the following sections deals with a specific, commonly-used procedure.

Do not worry if, when following the instructions, you make a mistake. Just try again, all the time noticing how the display guides you along and how the Type 4436's various functions are organised.

2.2.1. Choosing a Setup Number (See Fig. 2.1)

The Type 4436 has forty fixed setups, numbered **1** to **40**. Each contains a different combination of six parameters, which govern how the Type 4436 measures and assesses sound signals. So, if you you are making measurements to meet a particular standard, you should choose a setup whose parameter values comply with that standard. The Type 4436 also has a User Setup (number **0**), which lets you define some other combination of parameters. The following example shows how to choose **Setup 5,** whose combination of measurement parameters is given in Table 2.1. This setup complies with standards in some European countries. For more information about which setups serve which standards, see section 5.1.1.

1. Press **"On/Off".**

   The display indicates that it is ready, and also tells you what Setup the instrument is in.

2. Press **"Setup".**

   The display indicates that the instrument is in **Setup view**, and that you can view the **Setup number**.

3. Press **"Yes/OK"**.

   The display indicates the current Setup number. To the left of the display there will be an arrow or arrows (▲ and ▼).

4. Press ▲ or ▼ until the display indicates Setup number 5.

5. Press **"Yes/OK"**.

The display returns to **READY**, and indicates that the instrument is in **Setup 5**.

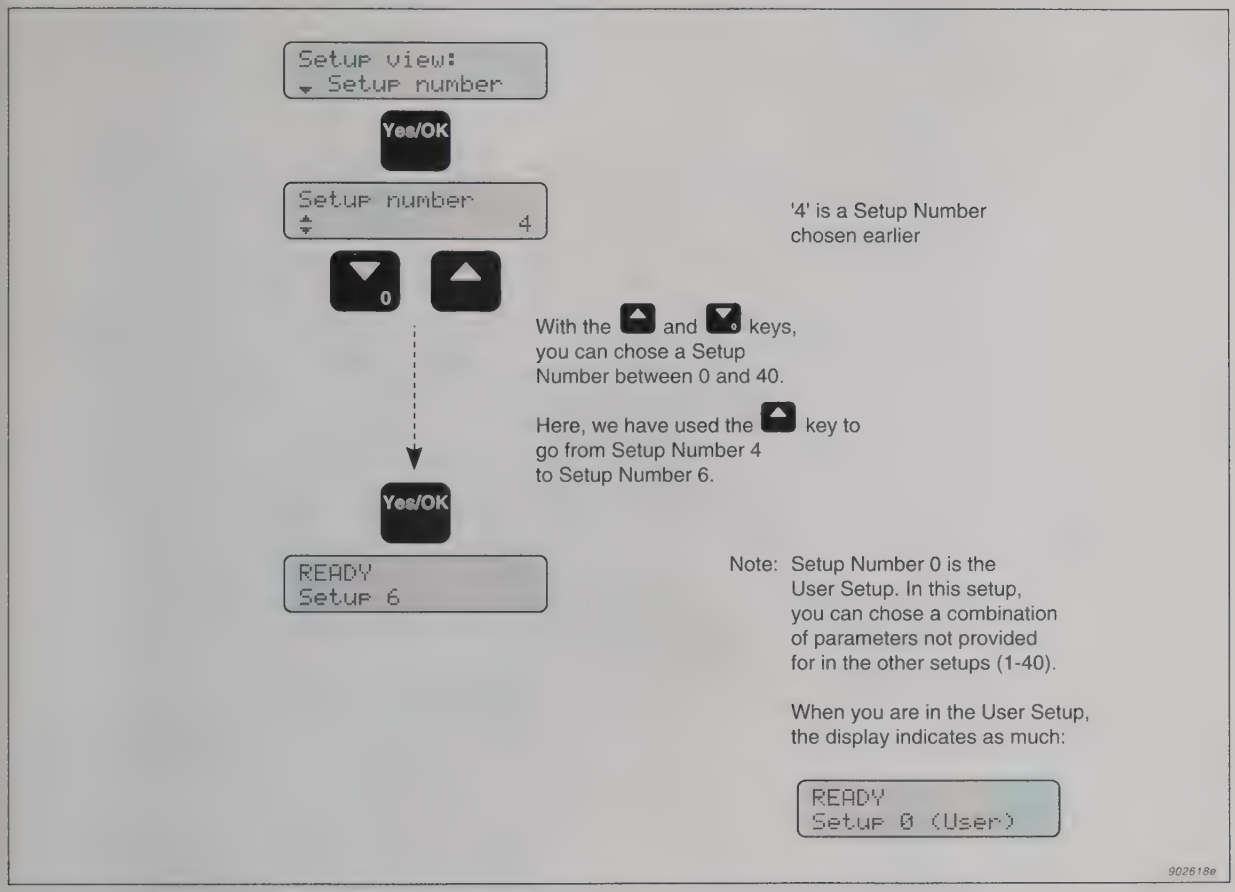
Setup view:
Setup number
Yes/OK
Setup number
4
'4' is a Setup Number chosen earlier
With the and keys, you can chose a Setup Number between 0 and 40.
Here, we have used the key to go from Setup Number 4 to Setup Number 6.
Yes/OK
READY
Setup 6
Note: Setup Number 0 is the User Setup. In this setup, you can chose a combination of parameters not provided for in the other setups (1-40).
When you are in the User Setup, the display indicates as much:
READY
Setup 0 (User)
902618e

Fig. 2.1. Choosing a setup number

Microphone	Int.
Time Weighting	Slow
Peak Filter	Lin.
8h 100% Level dB	90
Threshold dB	80
Exchange Rate (q)	3

Table 2.1. The measurement parameters in Setup Number 5

2.2.2. Calibration (See Fig. 2.2)

When you calibrate the Type 4436, you check that it is functioning correctly and confirm its accuracy. With the Type 4436, calibration adjustment is automatic, and should be performed before and after every measurement. We assume here that you are calibrating the Type 4436 with Brüel & Kjær's Sound Level Calibrator Type 4230.

1. Press **"Cal."**.

   The display tells you what the present calibration adjustment factor is in dB, and asks you if you want to exit (that is, if the present adjustment is OK).

2. Since you want to make a new calibration, press **"No"**.

   The display indicates that it is ready to start calibrating, and asks you if the present calibrator level is OK.

3. Let us assume that it is not OK. Press **"No"**.

   The display asks you to set a calibrator level. Let us say that you want a calibrator level of 94.0 dB (using Calibrator Type 4230).

4. Press these keys: **0 9 5 0**

   The display indicates that you have entered a calibrator level of 095.0 – that is, 95 dB. This is not what you want.

5. Press **"Clear"**.

   The wrongly entered numbers will be erased, and you can enter the calibration level that you want.

6. Press these keys: **0 9 4 0**

   The display indicates that you have entered a calibrator level of 094.0 – that is, 94.0 dB. This is what you want.

7. Press **"Yes/OK"**.

   The display confirms this newly entered calibrator level, and asks you if it is OK.

8. Attach the 1/4-inch adaptor (supplied with the Type 4436) to the Type 4230 Calibrator and then insert the end of the Type 4436's rubber tube into the 1/4-inch adaptor, so that it fits snugly.

9. Switch the calibrator on.

10. Press **"Yes/OK"** on the Type 4436.

    The display indicates that the Type 4436 is calibrating. Calibration takes a few seconds. Then the display indicates what the new adjustment is.

11. Press **"Yes/OK"**.

    The display returns to **READY**.

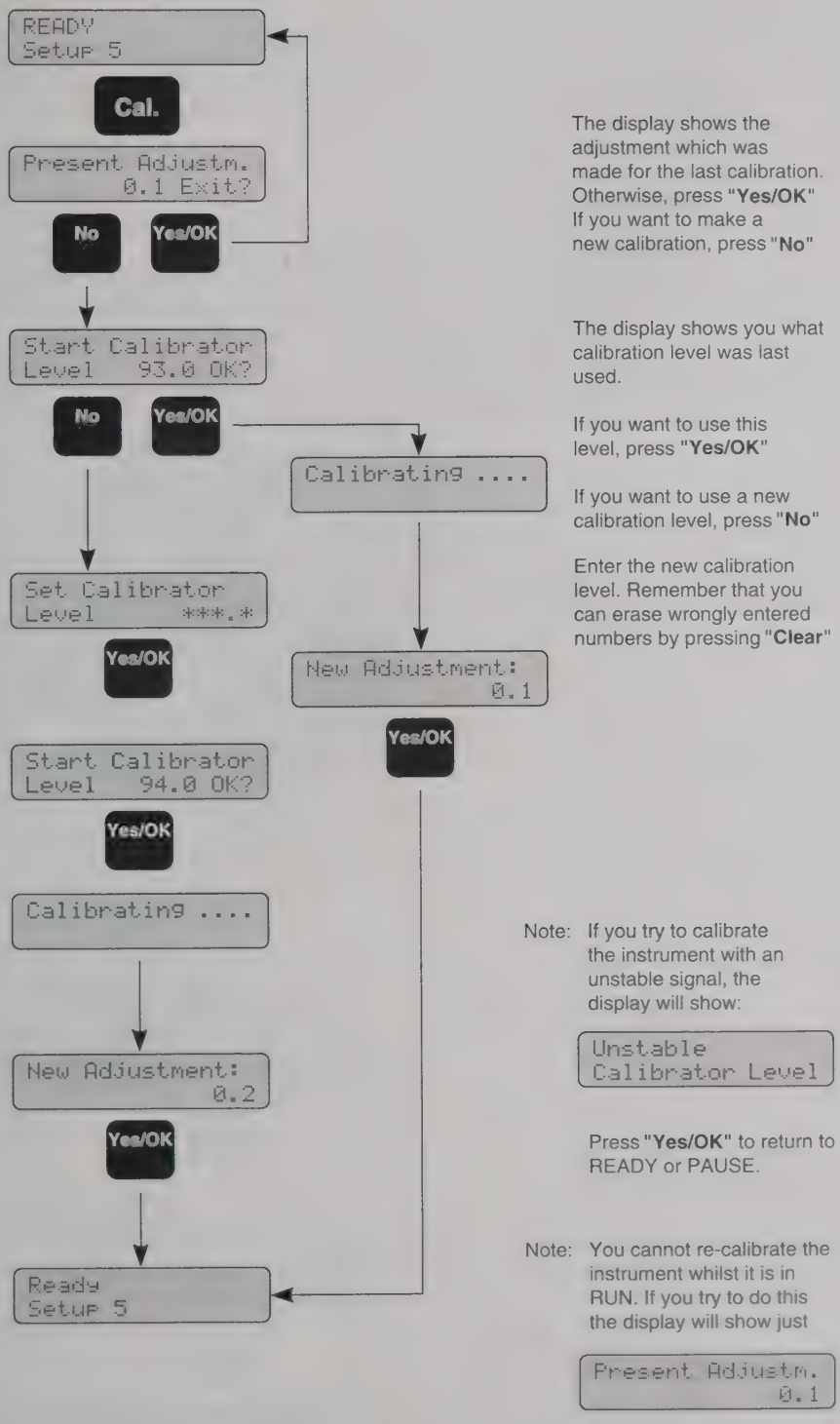
READY
Setup 5
Cal.
Present Adjustm.
0.1 Exit?
No
Yes/OK
Start Calibrator
Level 93.0 OK?
No
Yes/OK
Calibrating ....
Set Calibrator
Level ***.*
Yes/OK
New Adjustment:
0.1
Yes/OK
Start Calibrator
Level 94.0 OK?
Yes/OK
Calibrating ....
New Adjustment:
0.2
Yes/OK
Ready
Setup 5
The display shows the adjustment which was made for the last calibration. Otherwise, press "Yes/OK" If you want to make a new calibration, press "No"
The display shows you what calibration level was last used.
If you want to use this level, press "Yes/OK"
If you want to use a new calibration level, press "No"
Enter the new calibration level. Remember that you can erase wrongly entered numbers by pressing "Clear"
Note: If you try to calibrate the instrument with an unstable signal, the display will show:
Unstable
Calibrator Level
Press "Yes/OK" to return to READY or PAUSE.
Note: You cannot re-calibrate the instrument whilst it is in RUN. If you try to do this the display will show just
Present Adjustm.
0.1

Fig. 2.2. Calibrating the Type 4436

2.2.3. Starting Measurements (See Fig. 2.3)

During measurements, the Type 4436 receives sound signals, makes its calculations, and stores the results. It retains these results even when the instrument is off. Only when you make a new measurement will your previous set of measurement results be deleted.

1. Press **"Run"**.

   The display might indicate that the instrument is "warming up" which means that its Time Weighting networks are being made ready for measurements. Normally, this happens just after you have switched the instrument on, and lasts about fifteen seconds. It also appears, as in this instance, if you have changed the Time Weighting between measurements. The display then indicates that a new measurement is about to take place. Then the display indicates that the instrument is in the **RUN** mode (that is, it is making measurements). It also indicates the setup you are using.

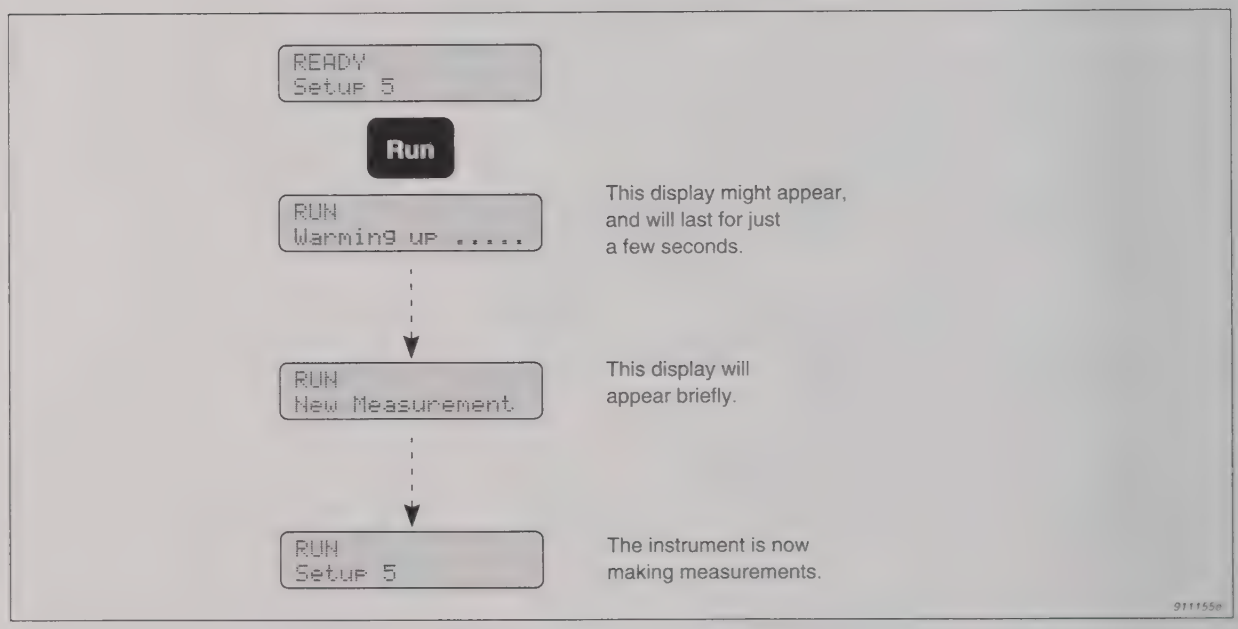

Fig. 2.3. Starting measurements

2.2.4. How to "Disable" the Pushkeys (See Fig. 2.4)

In some situations, you might want to "lock" the pushkeys. By doing this, you can, for example, ensure that a measurement in progress is not corrupted by someone tampering with the instrument or by the keys being accidentally pushed.

1. Press **"Code"**.

   The display indicates that it is about to switch off. Then four asterisks appear on the display. The display has been disabled, as have the keys of the instrument. Thus, you can be assured that the keys will not be accidentally activated during measurements.

2. Press these keys: **4 4 4 6**

3. Press **"Yes/OK"**.

   Nothing happens.

4. Press these keys: **4 4 3 6**

5. Press **"Yes/OK"**.

   The instrument returns to the **RUN** display. You have just re-activated the pushkeys and display of the 4436 by entering the correct code (**4 4 3 6**) and pressing **"Yes/OK"**.

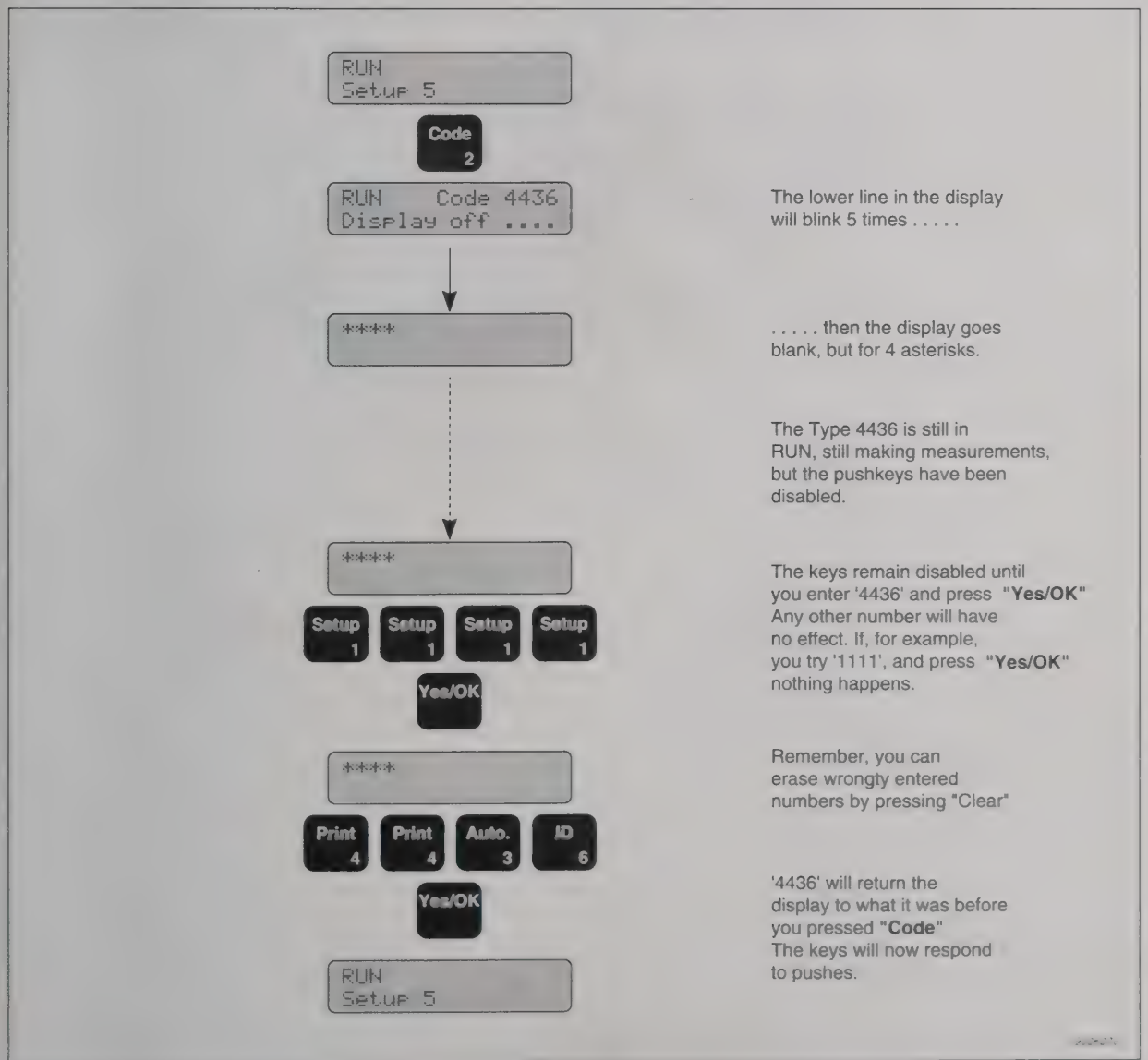
RUN
Setup 5
Code 2
RUN Code 4436
Display off ....
The lower line in the display will blink 5 times .....
****
..... then the display goes blank, but for 4 asterisks.
The Type 4436 is still in RUN, still making measurements, but the pushkeys have been disabled.
****
Setup 1
Setup 1
Setup 1
Setup 1
Yes/OK
The keys remain disabled until you enter '4436' and press "Yes/OK" Any other number will have no effect. If, for example, you try '1111', and press "Yes/OK" nothing happens.
****
Print 4
Print 4
Auto. 3
ID 6
Yes/OK
Remember, you can erase wrongty entered numbers by pressing "Clear"
'4436' will return the display to what it was before you pressed "Code" The keys will now respond to pushes.
RUN
Setup 5

Fig. 2.4. Entering the Code

2.2.5. Using "Pause" (See Fig. 2.5)

You might want to pause measurements when, for example, unusual noise events occur. By using the **Pause** option, you simply interrupt the measurement procedure. You do not bring it to an end.

1. Press **"Pause"**.

   The display indicates that it is in the **PAUSE** mode. It continues to indicate what Setup the instrument is in. During **PAUSE**, the instrument stops storing dose results (but can still show **SPL** and **Peak** measurements if you press **"SLM"**).

2. Press **"Run"**.

   The Type 4436 continues with its usual measurement routine. The Type 4436's memory has retained all the measurement data it recorded before you pressed **"Pause"**.

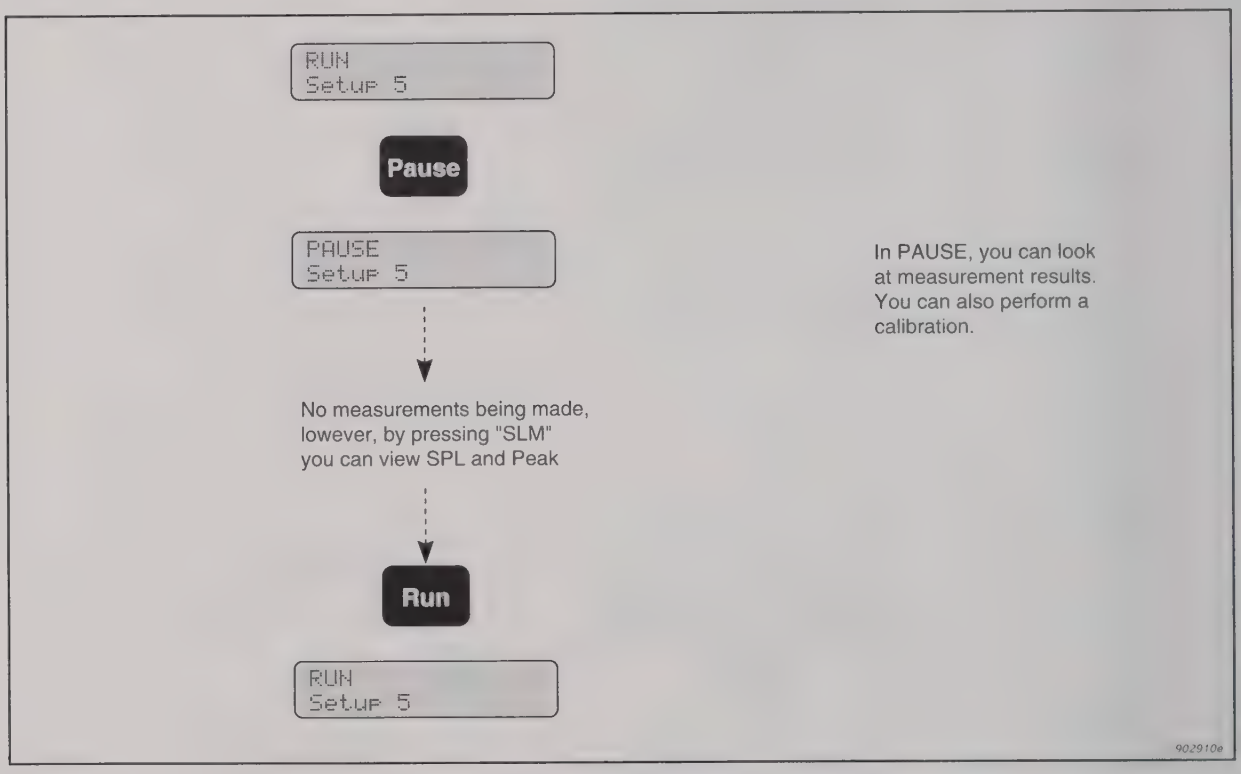

Fig. 2.5. Using Pause

2.2.6. Reading Dose Results (See Fig. 2.6)

You can read measurement results during or after measurements. Here, we shall read them during measurements. By doing so, you do not affect the measurement procedure in any way. While you are reading results, measurements are going on as usual. As well as being able to read **Dose Levels**, you also have access to **Noise Levels** and **Statistics**.

1. Press **"Dose"**. The display indicates the **Dose %**.
2. Press ▼ once. The display indicates the **8h Dose %**.
3. Press ▼ once. The display indicates the **Sound Exposure Pa^2h**.
4. Press ▼ once. The display indicates the **Sound Exposure 8h Pa^2h**.
5. Press ▼ once. The display asks you if the daily exposure is to be based on eight hours.
6. Press **"Yes/OK"**. The display indicates the **Daily Personal Noise Exposure** ($L_{EP,d}$).
7. Press ▼ once. The display indicates the **Personal Sound Exposure Level** (**PSEL**).
8. Press **"Yes/OK"**. The display returns to **RUN**.

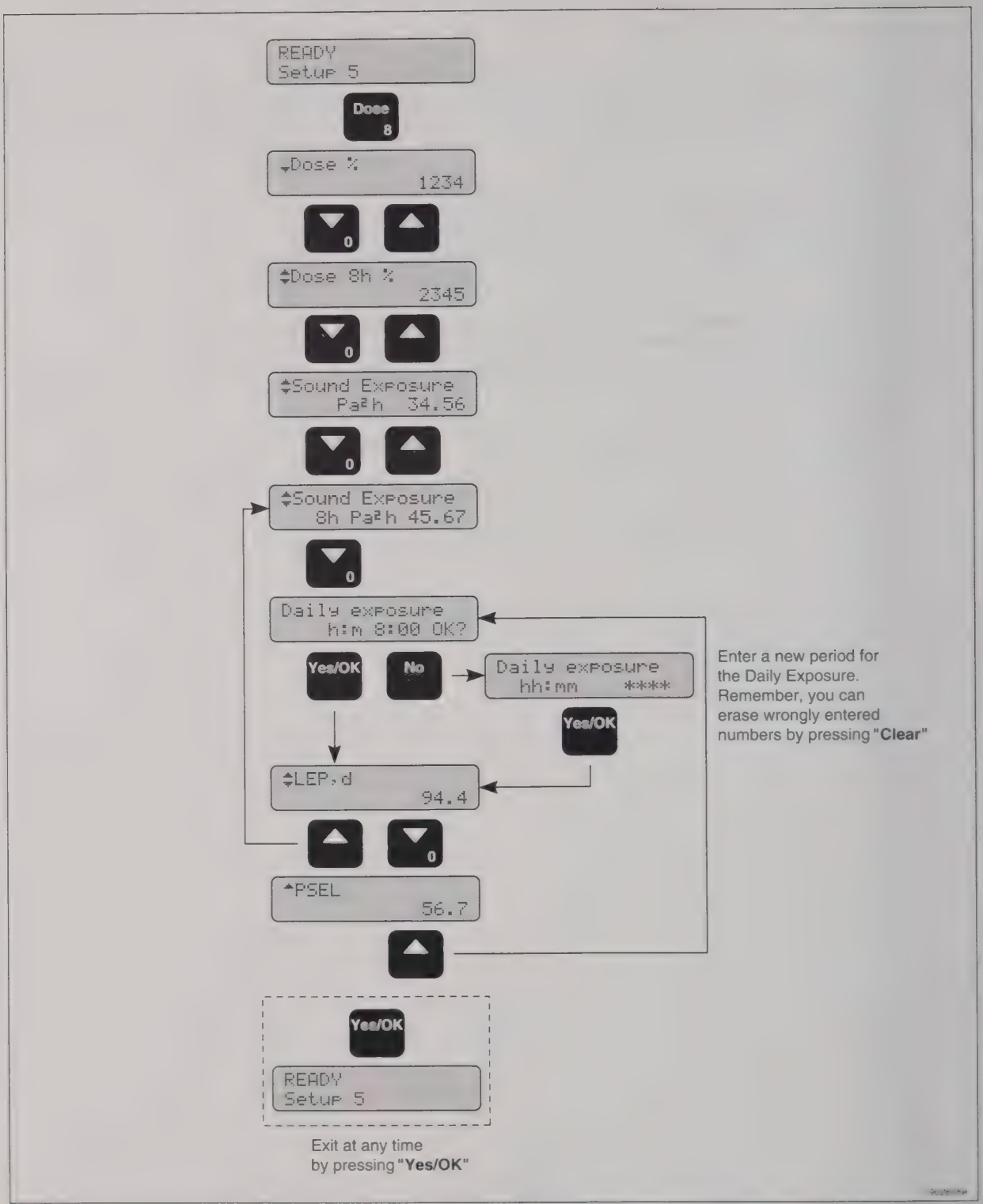

Fig. 2.6. Reading Dose Levels

2.2.7. Switching the Instrument Off (See Fig. 2.7)

1. Press **"On/Off"**.

   The instrument switches off, and measurements made up till this point are stored in the memory of the Type 4436. The next time you start measurements (by pressing **"Run"**), the instrument will delete all past measurement results from its memory, so if you want to keep a record of the results you have just made, you should write them down, print them or transfer them to a computer.

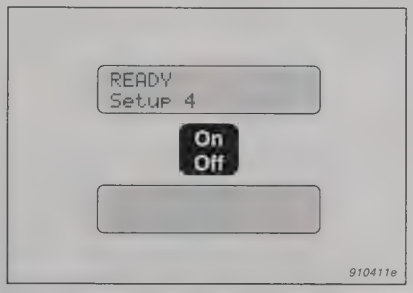

Fig. 2.7. Switching the instrument off

3. THE CONTROLS

In this chapter, the Type 4436's pushkeys and input and output sockets are briefly described. The information is intended as a quick guide. Fig. 3.1 gives an overview of the instrument and the pushkeys.

3.1. THE PUSHKEYS AND THEIR FUNCTIONS

"On/Off" Switches the instrument on or off. Under certain conditions (at the end of an automatically timed measurement, or when the battery's power low), the instrument switches itself off. In such cases, it retains the information from the measurement which you have most recently made. No information is lost.

"Cal." Automatically adjusts the Type 4436 to a defined sound level, produced by Sound Level Calibrator Type 4230 or Multifunction Acoustic Calibrator Type 4226. The Type 4436 compensates for the discrepancy between its reading of the signal and the actual dB value of the signal. Thereafter, the Type 4436 will continue to take that discrepancy into account when calculating both noise dose and noise level values. See section 4.3.

"Pause" Interrupts current measurements – i.e. interrupts the **RUN** mode. The measurement period is not divided into two distinct measurement sequences. Measurements made on either side of a pause both contribute to the one set of measurement results.

"Run" Starts measurements, deleting all old measurement data from the Type 4436's memory. Pressing **"Run"** also continues measurements if they have been interrupted by the **PAUSE** mode.

"SLM" Displays two sound level parameters – the Peak Level and the Sound Pressure Level (SPL). See section 7.4.

"Batt." Displays current battery voltage and an estimate of how much life the battery still has. See section 4.1.

"Clear" Erases incorrectly entered numbers.

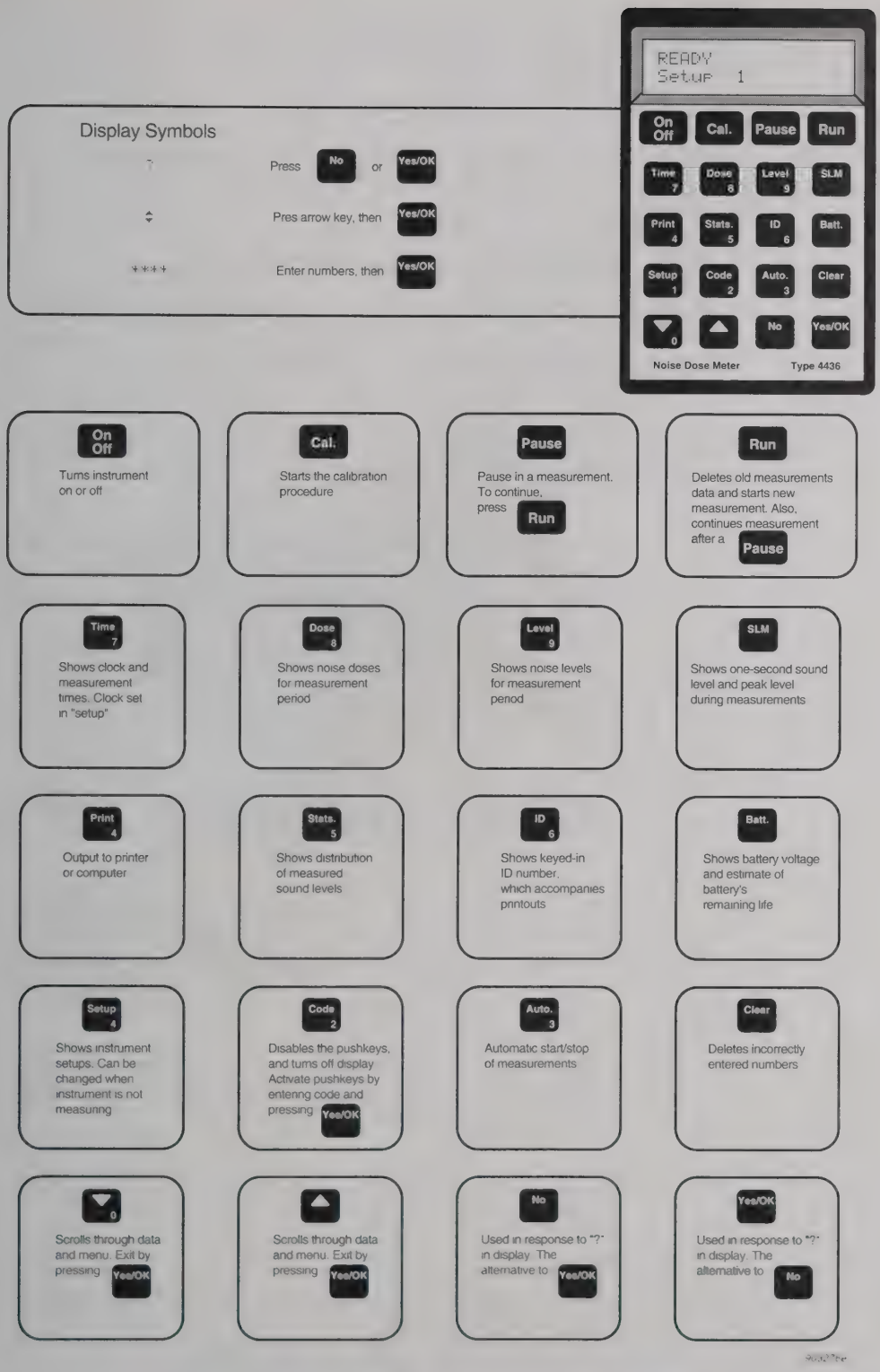

Fig. 3.1 The Type 4436, with pushkeys annotated

"Yes/OK"	Lets you accept an option offered to you on the display. Also lets you exit some routines, returning the display to where it was before you enetered that routine.
"No"	Lets you reject an option offered to you on the display.
▲ and ▼	Scroll through displayed options or results. Arrows in the display indicate when you can use the ▲ and ▼ keys. The ▼ pushkey leads you on to the next facility in a sequence. The ▲ pushkey brings you back to the previous facility in the sequence. If you continually press one of these keys, you can scroll quickly through options or results.
"Setup"	Gives access to various facilities which contribute to the Type 4436's performance (such as **Time**, **Levels**, and **Self Test**). Some of these options can be changed (like **Levels**), others perform a specific function (like **Self Test**). See Chapter 5.
"Print"	Transfers set-up information and measurement results to a printer or computer.
"Time"	Shows various time indicators: current time, start/end time of measurements, duration of **RUN** and **PAUSE** modes, overload duration.
"Dose"	Lets you read noise dose measurement results, during or after measurements. See section 7.1. If you continually press the **"Dose"** pushkey while a result is on the display, the data on the display will be updated.
"Level"	Lets you read sound level measurement results. See section 7.2. If you continually press the **"Level"** pushkey while a result is on the display, the data on the display will be updated.
"ID"	Marks print-outs with an identification number, defined by you. See section 8.3.
"Auto."	Presets the start and/or stop time of your measurement period. See section 6.1.2.
"Code"	Disables the pushkeys, thus preventing accidental pushes of the keys from corrupting measurements. See section 6.2.

"Stats." Lets you read statistical data. See section 7.3.

3.2. WHICH FUNCTIONS CAN BE USED IN WHICH MODES?

Table 3.1 gives the Type 4436's three main modes (**READY**, **RUN** and **PAUSE**), and tells you which functions can be used while the instrument is in these modes.

Function	OPERATING MODES		
Pushkeys	**READY**	**RUN**	**PAUSE**
Cal.	Yes	View only	Yes
Time	Yes	Yes	Yes
Print	Yes	If Baud Rate 9600	Yes
Setup	Yes	Yes for 'Printer' No for 'Self Test' Others: view only	Yes for 'Printer' No for 'Self Test' Others: view only
Dose	Yes	Yes	Yes
Stats.	Yes	Yes	Yes
Code	Yes	Yes	Yes
Level	Yes	Yes	Yes
ID	Yes	Yes	Yes
Auto.	Yes	Auto stop only	Auto stop only
SLM	No	Yes	Yes
Batt.	Yes	Yes	Yes
Clear	Yes	Yes	Yes

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Table 3.1. Which function can be used in which mode

Fig. 3.2 shows these modes, along with the "Off" display. This diagram illustrates how you enter and exit the main modes.

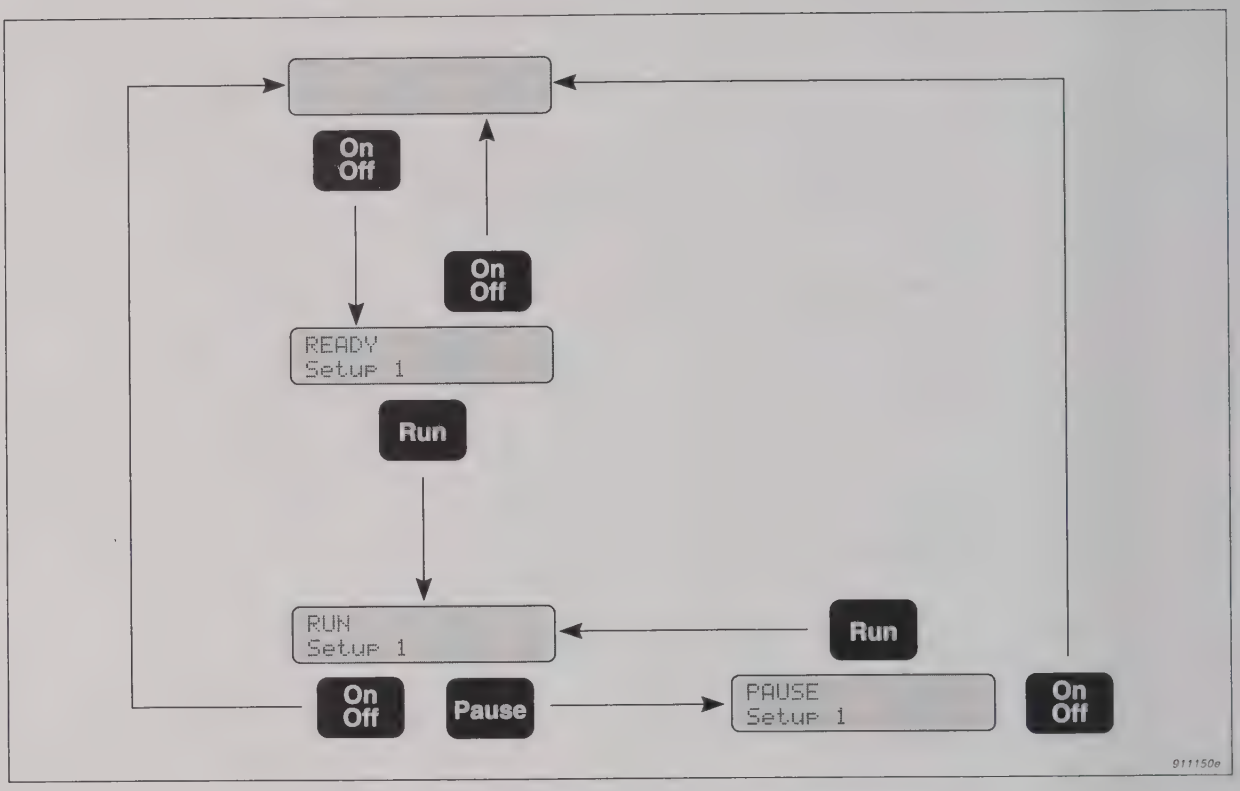


Fig. 3.2. The three main modes, and their relationship

3.3. THE EXT. PREAMP. SOCKET

The Type 4436 has an internal microphone, but can also be used with an external microphone, such as Brüel & Kjær's Microphone Type 4129, with Preamplifier Type 2642. The preamplifier attaches to the **Ext. Preamp.** (External Preamplifier) 5-pin socket at the top of the noise dose meter. See Fig. 3.3. For further details about using the Ext. Preamp. Socket, see section 4.2.3.

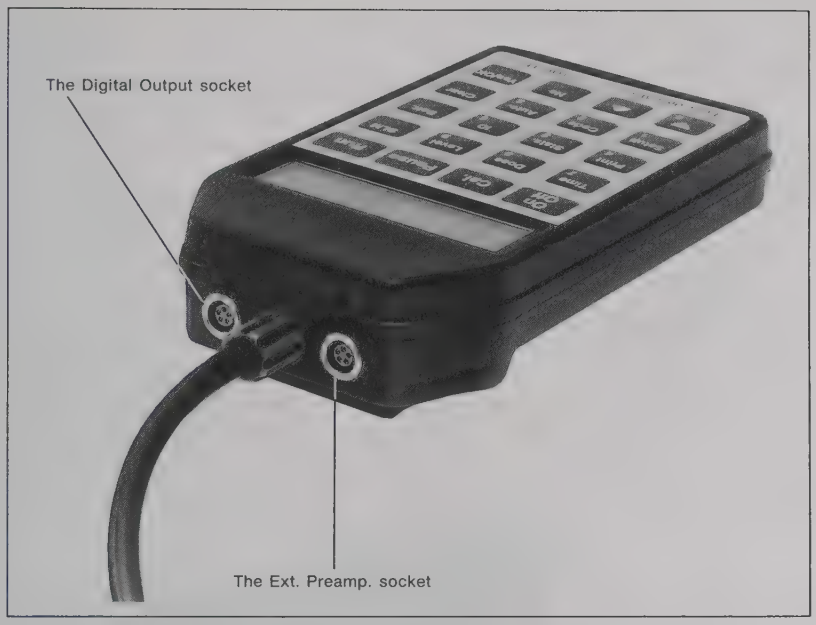


Fig. 3.3. The Ext. Preamp socket and the Digital Output socket

3.4. THE DIGITAL OUTPUT SOCKET

The Type 4436's digital output socket lets it communicate with a printer or personal computer. The Type 4436's 5-pin digital output socket is positioned at the top of the instrument, as shown in Fig. 3.3. More information about printing your results and using the Type 4436 with a computer, can be found in Chapters 8 and 9 respectively.

4. PREPARING THE TYPE 4436 FOR MEASUREMENTS

In this chapter, we shall describe the equipment which is supplied with the Type 4436, and also show you how to get the instrument ready for measurements – how to put in the battery, determine which microphone you want to use, attach the instrument to a worker or tripod, calibrate the instrument, and how to view and change the clock.

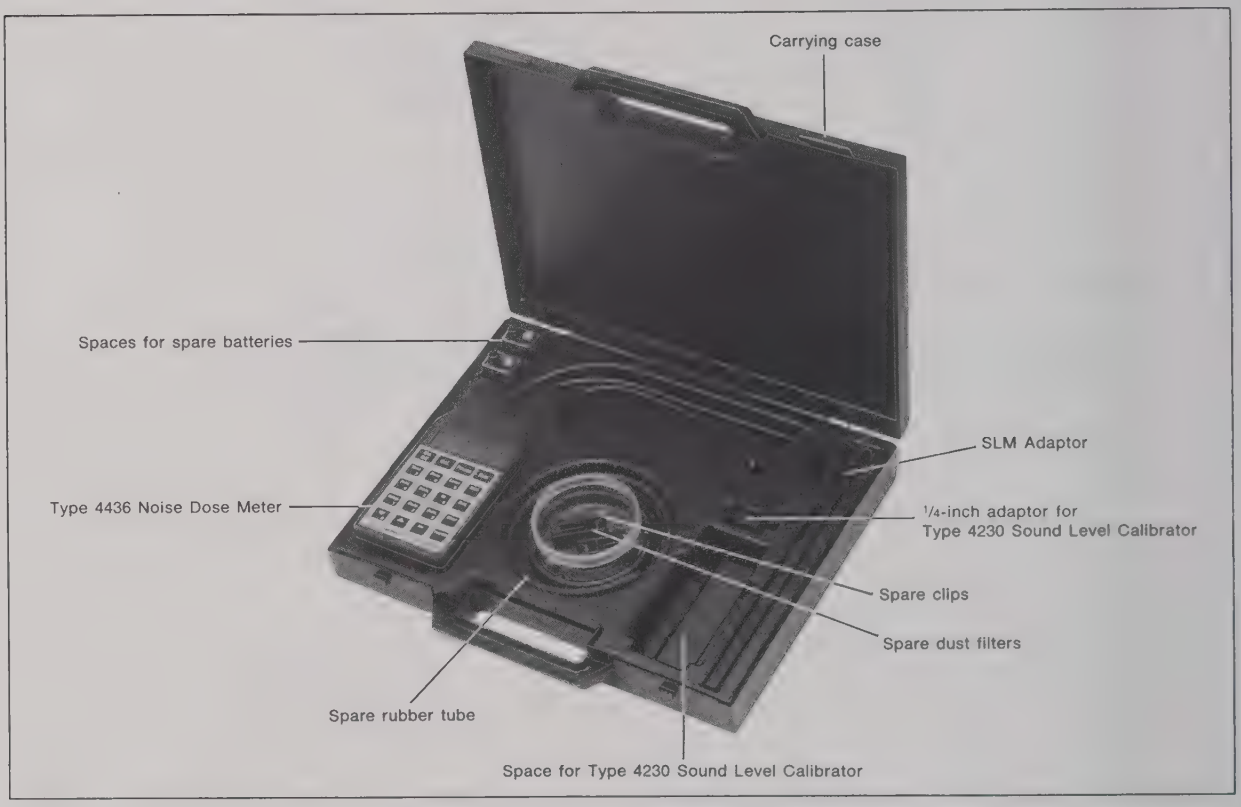


Fig. 4.1. The carrying case and equipment

When you get the Noise Dose Meter Type 4436, the instrument and all the equipment that comes with it is contained in Carrying Case QB 0017. See Fig. 4.1.

The carrying case contains the following:

- The Type 4436 (with rubber tube)
- A spare rubber tube

- Two clips for securing the rubber tube to clothing
- Four dust filters for the rubber tube
- Six dustcaps for the sockets at the top of the instrument
- One SLM Adaptor
- Two batteries
- One 1/4-inch Adaptor for Noise Level Calibrator Type 4230
- One pocket-sized User's Guide

You can find out more about the equipment which comes with the Type 4436, by reading the Specifications given in the Chapter 1 of this Manual.

4.1. THE BATTERY

The Noise Dose Meter Type 4436 uses one 9 V 'transistor' size, alkaline battery (IEC 6F22 or IEC 6LR61). The battery will last for at least 20 hours (but less than 24 hours) at 23°C. At low temperatures, the battery cannot supply as much power as it ordinarily does, and the instrument's **Low Batt.** will appear sooner than normal.

Note: If you intend to store the Type 4436 for some time, remove the battery.

4.1.1. How to Insert the Battery

1. Press the cover at the bottom of the Type 4436, and then slide it off. Arrows on the cover show you where to press it and which direction to slide it. See Fig. 4.2.
2. Remove the old battery.
3. Insert a new battery. Two symbols inside the compartment indicate which way the battery should be inserted.
4. Replace the cover, making sure that it gives a little click, which tells you that it is locked.

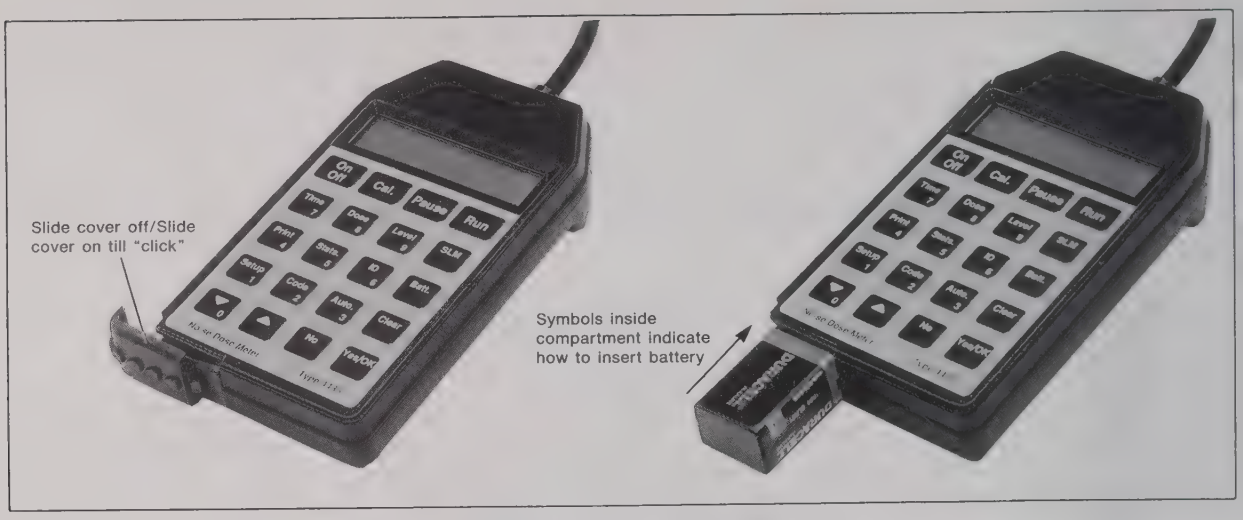


Fig. 4.2. Inserting the battery

4.1.2. How to Check the Battery's Power

You can check the battery's power when either **READY**, **RUN** or **PAUSE** is displayed, or in the SLM and Code functions.

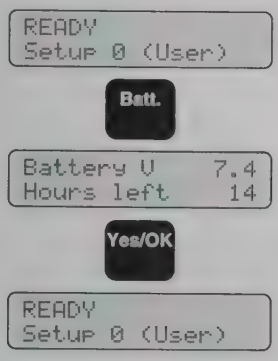
1. Press **"On/Off"** to switch the instrument on.

   If the display does not work, make sure that you have inserted the battery correctly. If you have just switched the instrument on, give the battery some time to settle before checking its power (a few minutes will do).

2. Press **"Batt."**.

   The display shows you the present voltage of the battery, and an estimate, in hours, of how much life the battery has left. In Fig. 4.3, the display is indicating that the present Battery Voltage is **7.4V**, and that the battery has about **14 hours** of life left.

3. To exit the **Batt.** function, press **"Yes/OK"**. The instrument then returns to the display it was showing before you pressed **"Batt."**. That is, it returns to either the **READY**, **RUN** or **PAUSE** display.



The display shows the present voltage of the battery (7.4V), and an estimate of how many hours' life the battery has left (14 hours).

Note: The range of the displayed voltage is 5.5 - 10.0 V. The range of the remaining hours' life is 0 - 21 hours.

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Fig. 4.3. Checking the battery

4.1.3. The Battery Low Indicator

The display shows a warning when the battery power is getting too low. See Fig. 4.4.

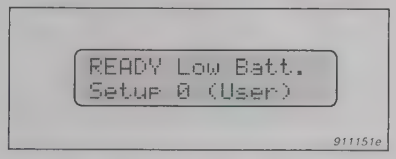

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Fig. 4.4. Battery low indicator

The instrument switches itself off when the battery gets too low for measurements to be made. Measurement data, however, will be retained for several days. If, however, the battery has no power left at all – or if you have removed it – an internal battery ensures that data is retained for at least one hour, during which time you can insert a new battery, and use your measurement results as you wish.

If, however, the Type 4436 is left with no power for a longer time, the instrument, when you use it again, will show some rather strange data for **Time**, **Setup** and measurement data. In this case, go through the options in the **Setup** function, and set them to the values you were previously using. Then press **"Run"**, **"On/Off"** and then **"On/Off"**.

Note: A measurement cannot be continued after the instrument has turned itself off because of a flat battery. So before making new measurements, record your old measurements (write them down, print them, or transfer them to computer).

4.2. PERSONAL OR AREA NOISE DOSE MEASUREMENTS?

Personal noise dose measurements indicate the noise dose to which a person (for example, a worker) is being exposed. In such cases, the Type 4436 is attached to the person in question.

Area noise dose measurements indicate the noise dose within a certain area (for example, a machine-shop). In such cases, the Type 4436 is either attached to a tripod, or carried around by hand.

In this section, we shall describe how to prepare the Type 4436 for each kind of noise dose measurement.

4.2.1. Personal Noise Dose Measurements

The Type 4436 has a clip on its back. This clip lets the instrument be secured to a breast pocket, a belt, the waist of a skirt or pair of trousers, etc.

Normally when you make measurements, you will use the Type 4436's internal microphone, which is built into the instrument. Sound signals are guided to this microphone by means of the rubber tube. A clip at the end of the rubber tube lets it be attached to the collar of a worker's clothes, a hat, a helmet, etc. The rubber tube has a dust filter at its end. The Type 4436 is supplied with four spare dust filters.

Attaching the Type 4436 to the User (see Fig. 4.5.)

We shall now describe how to attach the Type 4436 to the person who is wearing the instrument.

In Fig. 4.5, the first picture shows the correct way to insert the Type 4436 into a pocket. The other pictures have the Type 4436 outside the pocket simply to highlight the instrument's position. Generally a breast pocket provides the best protection, but if more convenient the Type 4436 can be attached elsewhere, such as on a belt or waist.

1. At the back of the Type 4436, there is a clip. If you intend to wear the instrument inside your pocket, this clip should be used to secure the instrument to the flap of the pocket. If you intend to attach the instrument to your trousers or skirt, the clip should be used to secure the instrument to the belt or waist of that piece of clothing. It is important that it be kept in a well protected position and does not interfere with a worker's movement or comfort.

2. The Type 4436 is supplied with two clips for the rubber tube. Take one of the clips and attach the tube to the worker's clothing so that it is about 10 cm away from the surface of the worker's body. If the end of the tube is positioned closer than this, the body surface distorts sounds.

Fig. 4.5. Attaching the Type 4436 to the user

4.2.2. Area Noise Dose Measurements

You perform these when you wish to measure the noise dose levels within a certain area – for example, the machine shop of a factory. To do this, you should use the Type 4436 with its SLM Adaptor and a tripod. The SLM Adaptor is supplied with the instrument, and lets the Type 4436 be attached to a tripod (for example, Brüel & Kjær's Portable Tripod UA 0802). The SLM Adaptor can also be used in hand-held operation, which is useful for short-duration measurements conducted in, for example, different areas of a machine shop.

Attaching the SLM Adaptor to the Type 4436 (see Fig. 4.6.)

1. Unscrew the notched brass collar which secures the rubber tube to the Type 4436.
2. Attach the ∪-shaped bracket at the bottom of the SLM Adaptor to the bolt which would normally accommodate the brass collar.
3. Re-screw the brass collar onto the bolt, thus securing the SLM Adaptor to the top of the instrument.
4. Take the top of the rubber tube (the end with the dust filter), and let it lie in the groove at the top of the SLM Adaptor (this might require just a little push).
5. Feed the tube into the groove which extends along the SLM Adaptor.
6. After you have fed the tube into the groove, use the clip at the back of the Type 4436 to secure any surplus tubing. There are rounded indents on this clip, and these hold the tubing in place.

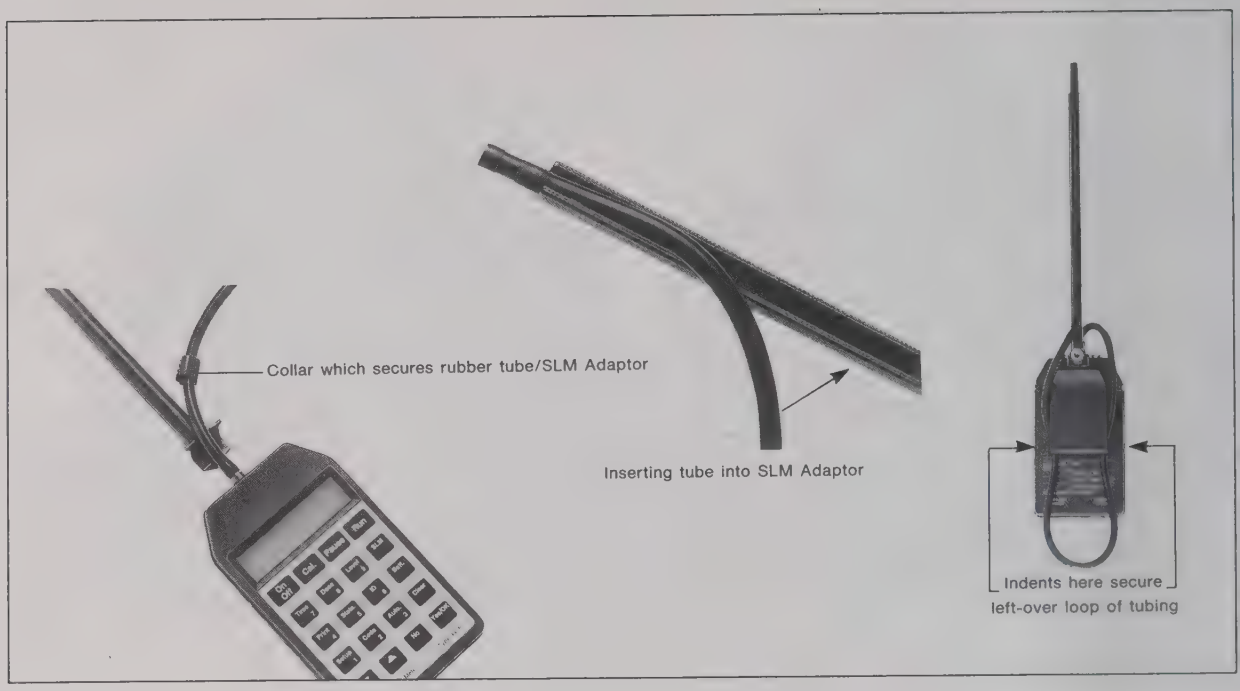

Collar which secures rubber tube/SLM Adaptor
Inserting tube into SLM Adaptor
Indents here secure
left-over loop of tubing

Fig. 4.6. Attaching the SLM Adaptor

Attaching the Type 4436 to a Tripod

In order for the Type 4436 to be attached to a tripod (e.g. Brüel & Kjær's Portable Tripod UA 0802), you first need to attach the SLM Adaptor to the Type 4436. On the underside of the SLM Adaptor, there is a threaded bush, into which the bolt at the top of the tripod can be screwed. See Fig. 4.7.

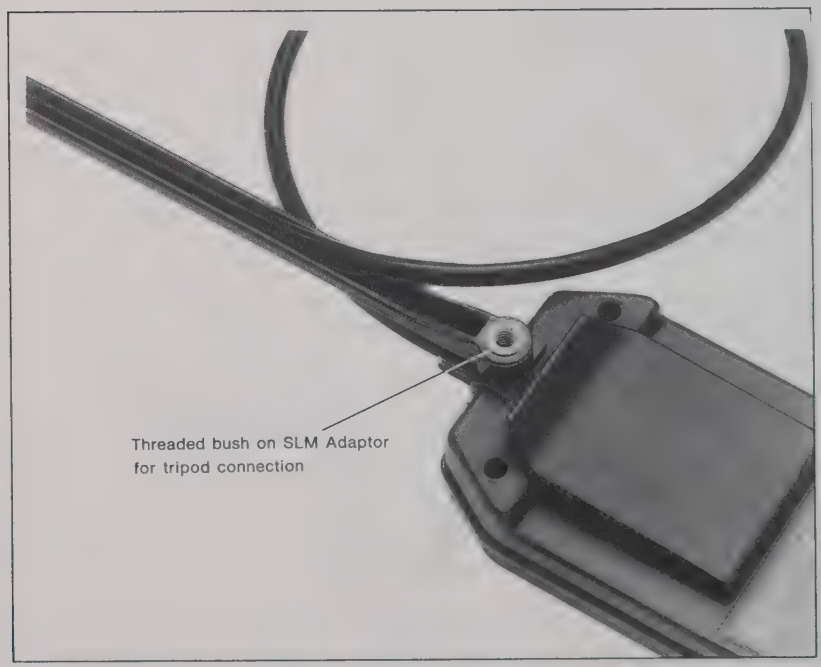


Fig. 4.7 The threaded bush on the underside of the SLM Adaptor

4.2.3. Using an External Microphone

For certain noise measurements, you might prefer to use an external microphone – for example, if you wish to measure noise levels which are below the 55 dB SPL threshold of the internal microphone. In such cases, you should use Brüel & Kjær's Microphone Type 4129 and Preamplifier Type 2642, which can be ordered separately. See Fig. 4.8.

Note: When you use the Type 4436 with the external microphone, the Dynamic Range of the instrument is shifted downwards. For more about this, see "Dynamic Range" in the Specifications at the end of Chapter 1.

Connecting the Preamplifier and ½-inch Microphone to the Type 4436

You must tell the Type 4436 that you are using an external microphone. See section 5.1.2. Remember to calibrate the instrument before and after making measurements with the preamplifier and microphone, and also when you return to using the Type 4436's internal microphone.

Look at Fig. 4.6 to see how to fit the SLM Adaptor. Then see the following instructions.

1. Carefully screw the microphone onto the top of the preamplifier.

2. With equal care, insert the preamplifier's plug into the 5-pin **Ext. Preamp.** socket on the top of the Type 4436 (see Fig. 3.3.). Make sure that the red dots on the plug and socket are aligned.

3. Gently push the thinner part of the preamplifier into the top of the SLM Adaptor. See Fig. 4.8.

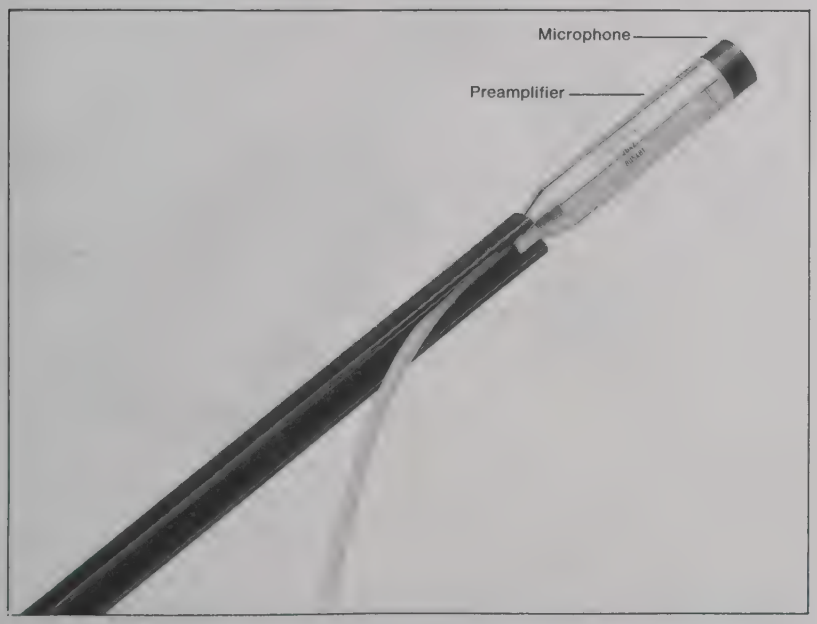


Fig. 4.8. Preamplifier Type 2642 and Microphone Type 4129

4. Feed the preamplifier's cable into the groove which extends along the SLM Adaptor. Fig.4.6 shows you how to do this for the rubber tube, and it's the same procedure for the preamplifier's cable.

5. After you have fed the cable into the groove, use the clip at the back of the Type 4436 to secure any surplus cable. There are rounded indents on this clip, and these hold the cable in place. Fig. 4.6 shows you how to do this for the rubber tube, and it is the same procedure for the preamplifier's cable.

4.3. CALIBRATION

You can calibrate the Type 4436 with Brüel & Kjær's Sound Level Calibrator Type 4230 or the Multifunction Acoustic Calibrator Type 4226. We recommend that you calibrate the instrument before and after every measurement. We shall now describe how you calibrate the instrument.

4.3.1. Connecting Sound Level Calibrator Type 4230 to the Type 4436

The Type 4436 is supplied with a special 1/4-inch adaptor (DE 0056), which lets the rubber tube and the calibrator fit each other snugly. Fig. 4.9 shows the Type 4436 and Type 4230 together.

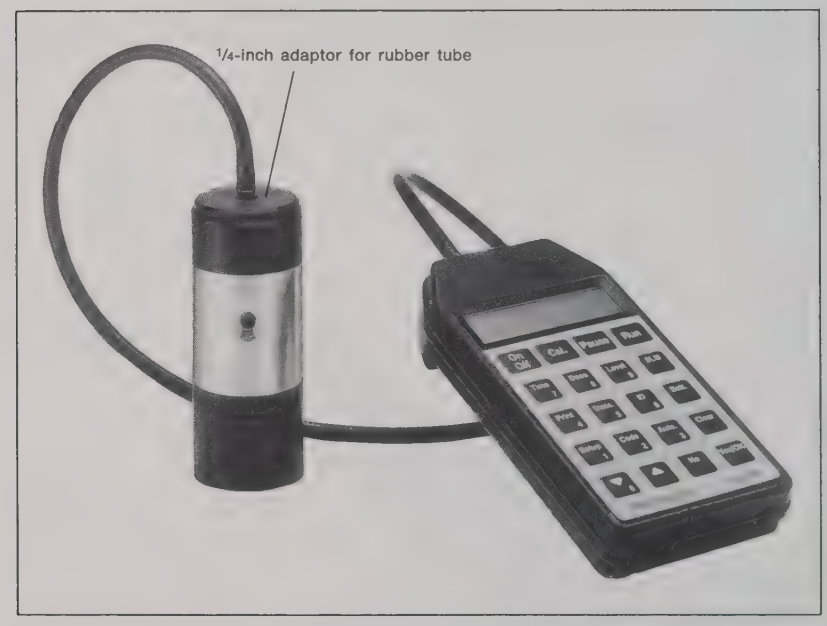


Fig. 4.9. The Type 4436 and the Type 4230

1. Remove the 1/2-inch adaptor from the top of the Type 4230 Calibrator by pulling it off gently.

2. Gently push the 1/4-inch adaptor into the top of the Type 4230 Calibrator. Make sure that the adaptor fits snugly.

3. Insert the end of the rubber tube into the adaptor.

   The Type 4436 is now ready to be calibrated.

4.3.2. Connecting the Multifunction Acoustic Calibrator Type 4226 to the Type 4436

The Type 4226 is supplied with a 1/4-inch adaptor, which lets the rubber tube and the calibrator fit each other snugly. Fig. 4.10 shows the Type 4436 and the Type 4226 together.

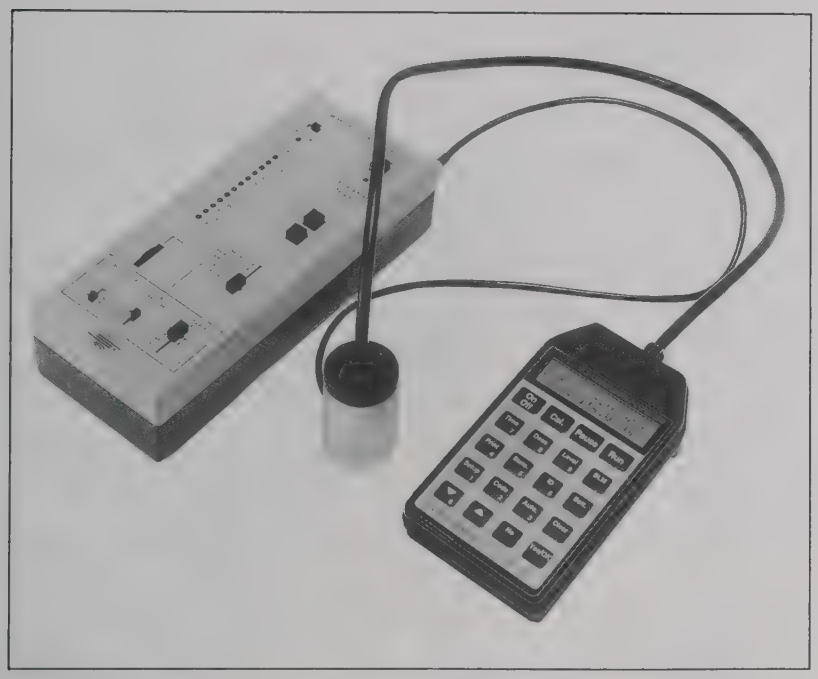


Fig. 4.10. The Type 4436 and the Type 4226

1. Gently push the Type 4226's 1/4-inch adaptor into the Type 4226's coupler. Make sure that the adaptor fits snugly.

2. Insert the end of the rubber tube into the adaptor.

   The Type 4436 is now ready to be calibrated.

   Note: When you use the Type 4226 to calibrate the Type 4436, you should use the following set-up for the Type 4226:

Power:	**"On"**
Function:	**"Calibration"**
SLM Response:	**"Pressure"**
Sound Level:	**"94 dB" (1 kHz is recommended) at "Inv. A."**

Other frequencies for 94 dB at "Inv. A" can be used, *except* for 31.5 Hz (the lowest frequency).

4.3.3. Calibrating the Type 4436

You can calibrate the Type 4436 only in the **READY** and **PAUSE** modes. When in the **RUN** mode, you can only view the present calibration adjustment. You cannot perform a calibration.

With the Type 4436 showing either the **READY** or **PAUSE** display (not **RUN**), connect the Type 4436 to your calibrator. Make sure that your calibrator is in good working order.

We shall now deal with each stage of the calibration procedure in turn. Fig. 4.11 illustrates the relevant pushkeys and displays.

Present calibration adjustment

1. Press **"Cal."**

   The display tells you the present calibration adjustment to the read-out in dB and asks you if you want to exit (that is, if the present adjustment is OK).

   Note: When using the internal microphone any calibration adjustment indication between –3 and +4 dB is acceptable provided that the reading remains constant for all calibrations using the same instrument. Similarly, when using a Type 4129 as an external microphone any reading between –8 and –14 dB is acceptable. If the reading does not remain reasonably constant for all calibrations, check that you are using the same microphone and calibrator and that your calibrator is properly connected and is working correctly.

2. If it is OK, press **"Yes/OK"**.

   The display returns to what it was showing when you pressed **"Cal."**.

3. If, however, you wish to do a new calibration (and the display is showing **READY** or **PAUSE**), press **"No"**.

Calibrator level

When you have told the instrument that you want to do a new calibration, the display then shows you a calibrator level (the one last chosen), and asks you if that is OK.

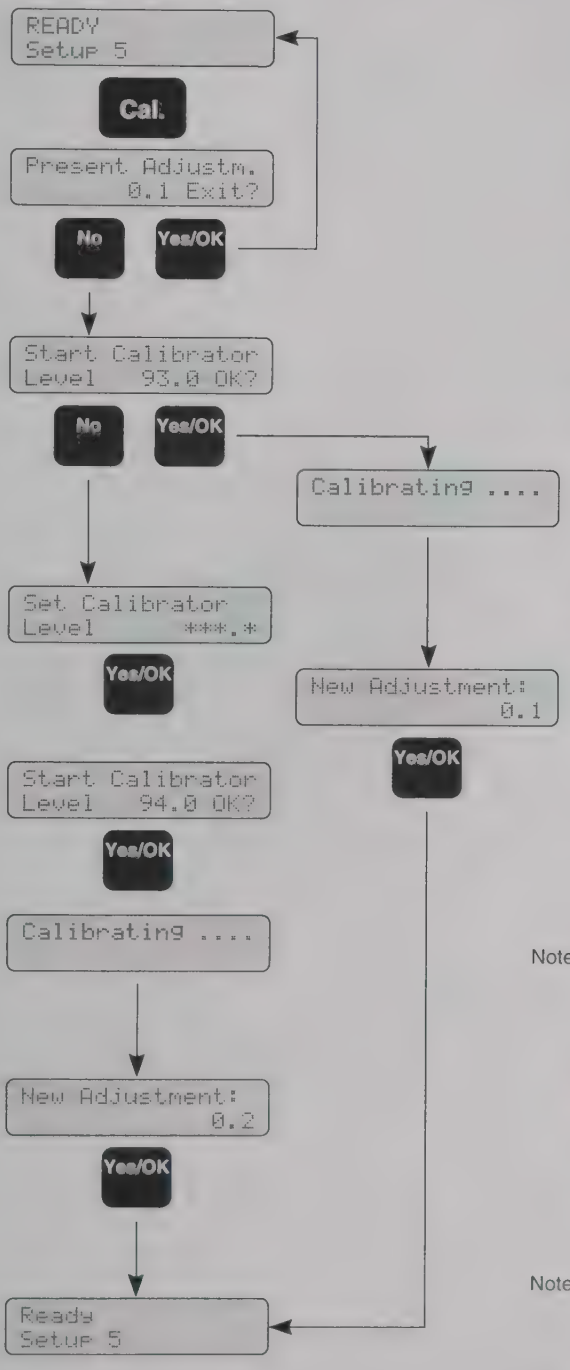
1. If it is OK (that is, if the calibrator level shown on the display corresponds to the level emitted by your calibrator), switch on the calibrator, and press **"Yes/OK"**.

   The display indicates that the Type 4436 is calibrating. This takes a few seconds (there might even be a short delay beforehand, which the display also indicates).

2. Press **"Yes/OK"** when the display shows the new calibration adjustment.

   The display then returns to either the **READY** or **PAUSE** display.

3. If, however, the calibrator level displayed is not OK, you should press **"No"** and proceed as indicated below.



The display shows the adjustment which was made for the last calibration. Otherwise, press "**Yes/OK**" If you want to make a new calibration, press "**No**"

The display shows you what calibration level was last used.

If you want to use this level, press "**Yes/OK**"

If you want to use a new calibration level, press "**No**"

Enter the new calibration level. Remember that you can erase wrongly entered numbers by pressing "**Clear**"

Note: If you try to calibrate the instrument with an unstable signal, the display will show:

```
Unstable
Calibrator Level
```

Press "**Yes/OK**" to return to READY or PAUSE.

Note: You cannot re-calibrate the instrument whilst it is in RUN. If you try to do this the display will show just

```
Present Adjustm.
0.1
```

Fig. 4.11. Performing a calibration

Entering a new calibrator level

When you have indicated that the present calibrator level is not OK, the display invites you to set a new calibrator level. You should key in this number. You have to use four figures, so therefore if your calibrator produces a calibrator level of 94.0 dB, for example, you should key in **0940** (appearing on the display as **094.0**). Remember that you can erase wrongly entered numbers by pressing **"Clear"**.

1. When you have keyed in the correct calibrator level, press **"Yes/OK"**.

   The display then presents you with the calibrator level that you have just keyed in, and asks you if it is OK. If it is not OK, press **"No"**, and enter the correct calibrator level.

2. If, however, the displayed calibrator level is OK, press **"Yes/OK"**.

   The display indicates that the Type 4436 is calibrating. This takes a few seconds (there might even be a short delay beforehand, and the display indicates that also). Then the display shows the new calibration adjustment.

3. Press **"Yes/OK"**.

   The display returns to either **READY** or **PAUSE**.

The instrument retains a calibration adjustment until you perform another calibration. Switching the instrument off does not affect the calibration adjustment level.

Once again, we recommend that you calibrate the Type 4436 before and after measurements. Also we recommend that you label the Type 4436 so that for future calibrations you can easily check what calibration adjustment value should be displayed for a particular instrument, as well as which microphone and calibrator should be used for the calibration.

Note: During calibration, the Type 4436 makes two 1-second measurements. If these correspond, calibration is successful. If not, however, the instrument makes up to four extra 2 × 1-second measurements. If the measurements still do not correspond, the error message **Unstable calibrator level** appears. If this happens, check that the Type 4436 and your calibrator are properly connected, and that the calibrator is working correctly. Then try calibration again. If the **Unstable calibrator level** persists, contact your local Brüel & Kjær service representative.

4.4. THE TIME

The **Time** function lets you view (not change) certain time parameters when the instrument is in the **READY**, **RUN** or **PAUSE** mode.

There are four options in the **Time** function. The procedure for obtaining these options follows the same pattern, as given in the following instructions. Fig. 4.12 illustrates the relevant displays and pushkeys.

1. Press **"Time"**.

2. Use ▼ or ▲ to obtain the option that you want.

3. Press **"Yes/OK"** when you want to exit the **Time** function.

We shall now describe the **Time** parameters in turn.

Clock

The display shows the current month, day and time of day. Fig. 4.12 shows, as an example, that the time is **12:34** (**hh:mm**) and it is the 5th. of October, given by **5–10** (**D–M**).

Note: The Type 4436's clock does not realise that there are twenty-nine days in February during leap years. So, once every four years you have to set the clock for the twenty-ninth of February (see section 5.2.1). After the twenty-ninth of February, the clock will automatically proceed to the first of March.

Start and End Times

The display shows the start and end times of the measurement period. If you check the measurement period during an actual measurement, the time indicated after the word **End** indicates the *current* time – the time when you pressed **"Time"** – and not the time when the measurement ended (because, of course, it has not ended yet).

Fig. 4.12 shows that either the current measurement period started at 10:07 and it was 11:48 when you pressed **"Time"**, or that the last measurement started at 10:07 and ended at 11:48.

Measurement and Pause Durations

The display shows the measurement and pause durations.

The period beside the word **Run** indicates, in hours and minutes, the duration of your last measurement period (excluding pauses) or how long the current measurement has been going on (excluding pauses).

The period beside the word **Pause** indicates, again in hours and minutes, the accumulated duration of any pauses that have occurred during the measurement period. The **Pause** duration is not updated until you next press **"Run"**.

In Fig. 4.12, the measurement period was effectively 1 hour and 40 minutes. The accumulated pauses lasted 1 minute. Therefore, from the time you started measurements till the time you completed measurements, 1 hour 41 minutes passed.

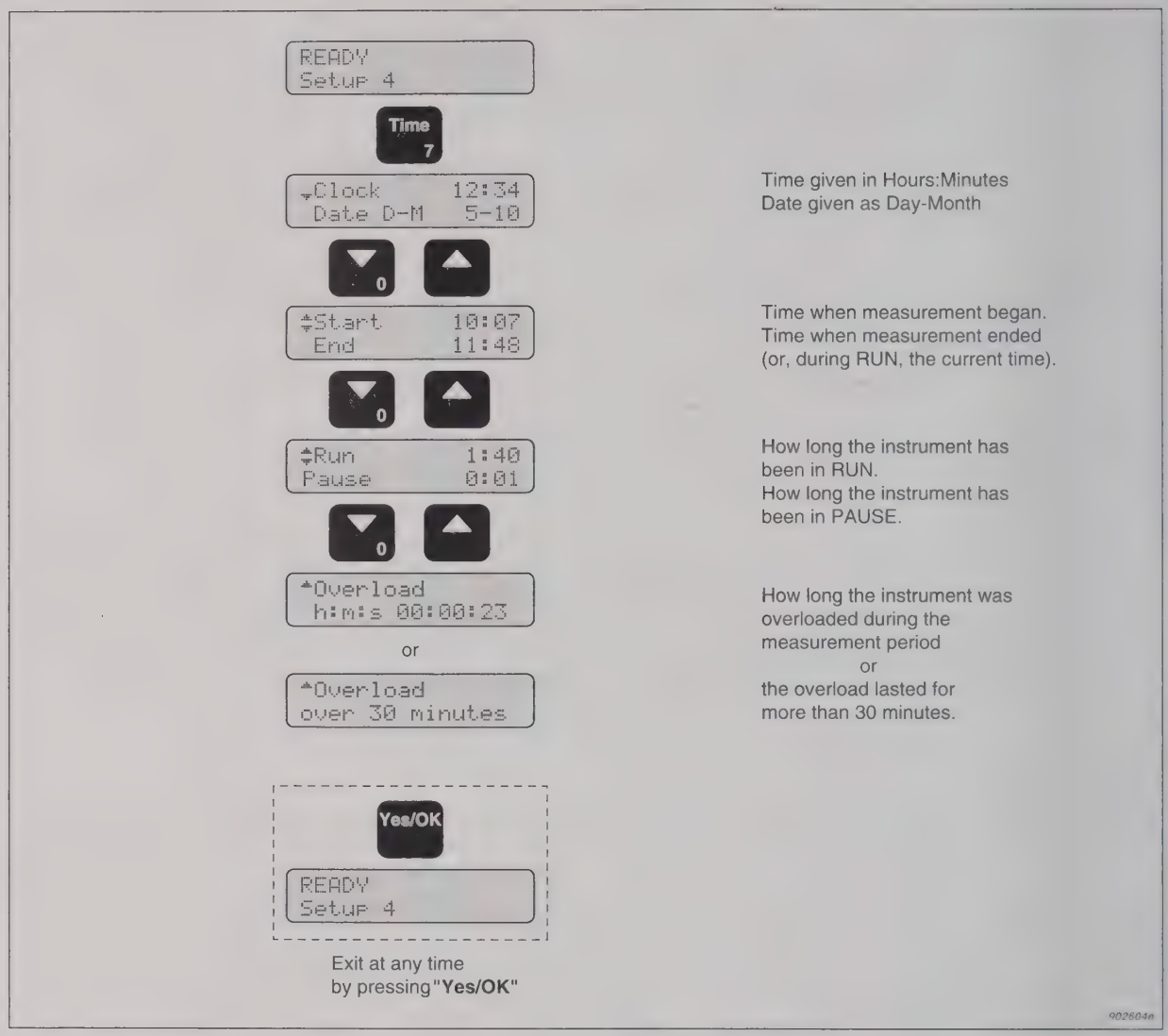


Fig. 4.12. Using the Time options

Overload Time

The display shows the duration for which the input signal was excessive. The display you see depends on whether the overload has lasted for thirty minutes or more.

If the overload has not lasted for more than thirty minutes, you will see something similar to the upper **Overload** display in Fig. 4.12. This shows the duration of the overload in hours, minutes and seconds.

If, however, the overload did last for more than thirty minutes, you will see the lower **Overload** display in Fig. 4.12.

5. THE SETUPS AND THE SETUP FUNCTION

In this chapter, we shall describe the various options available to you when you press **"Setup"**. Fig. 5.1 shows these options. As you can see, there are six options. Since the **Setup Number** option relates directly to the **Input** and **Levels** options, we shall deal with these three options first. Then we shall discuss the **Time**, **Printer** and **Self Test** options, which are not affected when you change the setup number.

5.1. THE SETUP NUMBER

The first option available in **Setup** is **Setup Number.** The Type 4436 offers forty fixed setups (numbers 1 to 40) and a user-definable setup (number 0). The Type 4436 retains a setup number, even when you switch the instrument off, and will display the current setup number in the **READY**, **RUN** or **PAUSE** mode. The Setup Number you choose determines the values assigned to the following **Input** and **Levels** parameters.

Input:	Microphone Time Weighting Peak Filter
Levels:	8 h 100% Level dB Threshold dB Exchange Rate (q)

The difference between the fixed setups and the **User Setup 0** is as follows:

Fixed Setups: The setup number you choose automatically determines the settings of the **Input** and **Levels** parameters (see Table 5.1). Thus, when you enter the **Input** and **Levels** functions, you can only read the parameters. To change them, you have to change setup number.

User Setup 0: You can enter the **Input** and **Levels** functions and change the parameters directly (but only in the **READY** mode – in the **RUN** or **PAUSE** mode, you can only read them). You should use **User Setup 0** if none of the fixed setups satisfies the standard with which you are working.

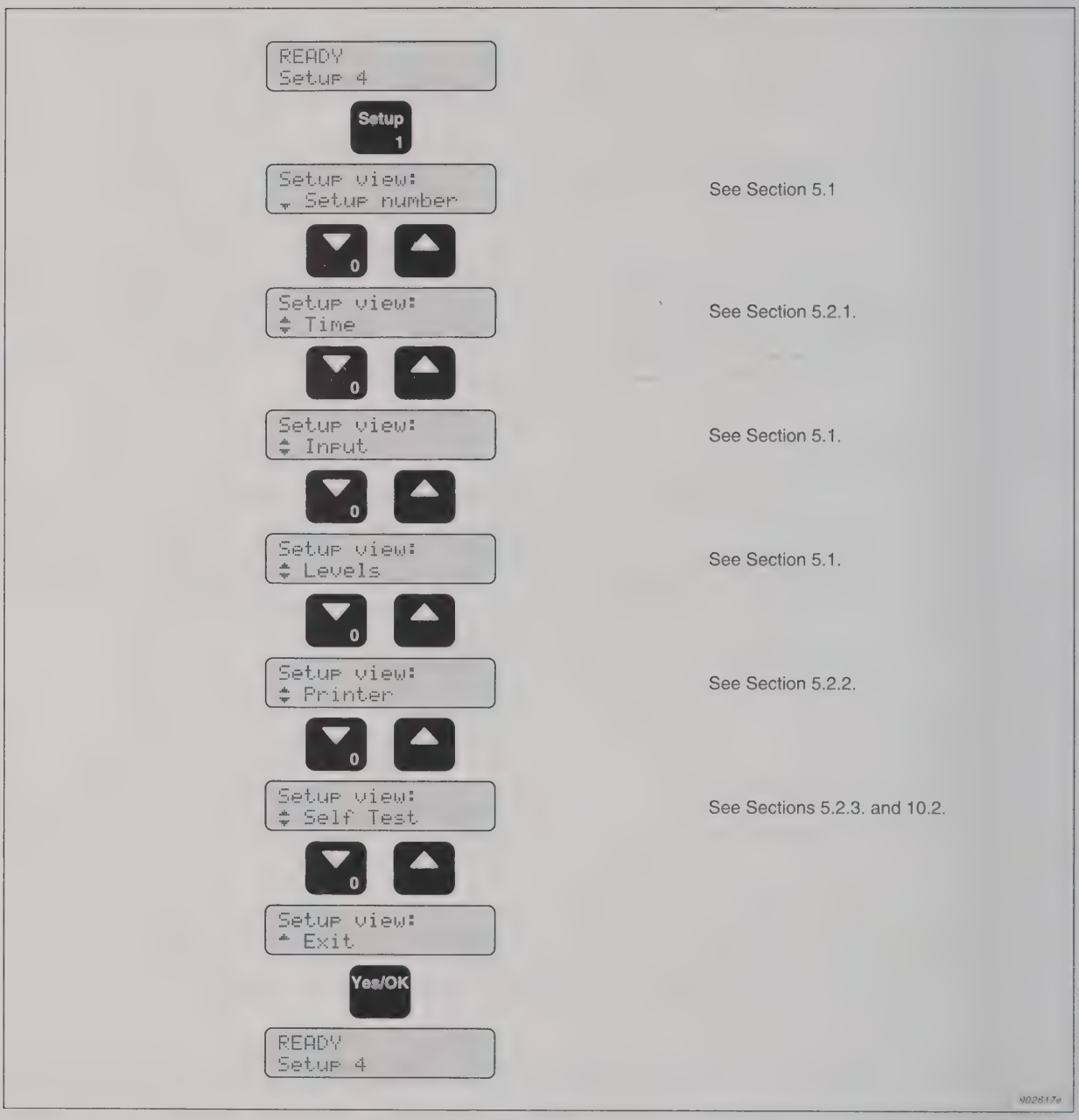


Fig. 5.1. The Setup options

5.1.1. Selecting a Setup Number

The variety of Input and Levels parameters offered by the setups of the Type 4436 reflects the variety of standards which apply to these parameters. Countries have different standards, and within countries the standards can also vary. If you are in doubt about which standard you should be working with, or which **Input** and **Level** parameters you should choose, contact your local Brüel & Kjær representative, who will give you the information that you need.

As a general guideline, it should be noted that in Europe, the Exchange Rate is **3**. Assuming that a **Slow** Time Weighting and the **Internal** microphone are used, you can see from Table 5.1 that the Setup Number for a European country will be either 1, 2, 3, 4 or 5. In the USA, however, the Exchange Rate is for the most part **5**, so the Setup Number used there will be either 8, 9 or 10 (again assuming a **Slow** Time Weighting and the **Internal** microphone).

Setup Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Microphone	Int.	Int.	Int.	Int.	Int.	Int.	Int.	Int.	Int.	Int.
Time Weighting	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Slow
Peak Filter	Lin.	Lin.	Lin.	Lin.	Lin.	Lin.	Lin.	Lin.	Lin.	Lin.
8 h 100% Level dB	85	90	85	90	90	90	84	85	90	90
Threshold dB	off	off	75	75	80	off	80	off	80	90
Exchange Rate (q)	3	3	3	3	3	4	4	5	5	5
Setup numbers 11 to 20 follow the same pattern as Setup numbers 1 to 10, but the **Time Weighting** is **Fast**.										
Setup numbers 21 to 30 follow the same pattern as Setup numbers 1 to 10, but the **Microphone** is **External**.										
Setup numbers 31 to 40 follow the same pattern as Setup numbers 1 to 10, but the **Time Weighting** is **Fast** and the **Microphone** is **External**.										

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Table 5.1. Setups 1 to 10, with Setups 11 to 40 described

To select a **Fixed Setup 1** to **40** or **User Setup 0**:

1. Press **"Setup"**.

   The display shows the current Setup number (see Fig. 5.2). Now you can select the setup number you want to use.

2. Press, and keep pressing ▼ or ▲ until the display shows the Setup Number that you want.

3. When the display shows the Setup Number that you want, press **"Yes/OK"**. The display returns to the **READY** mode, and confirms the setup that you have chosen.

User Setup 0 can be especially useful if you want to use a setup which differs only slightly from one of the fixed setups. By selecting the the fixed setup and then **User Setup 0**, you transfer the parameter values of the fixed setup to **User Setup 0.** All you then need to do is make the change that you need (using the **Input** or **Levels** option).

Note: "Int." in Table 5.1 indicates that the Internal Microphone will be used. "Lin." indicates that the Peak Filter will be Linear.

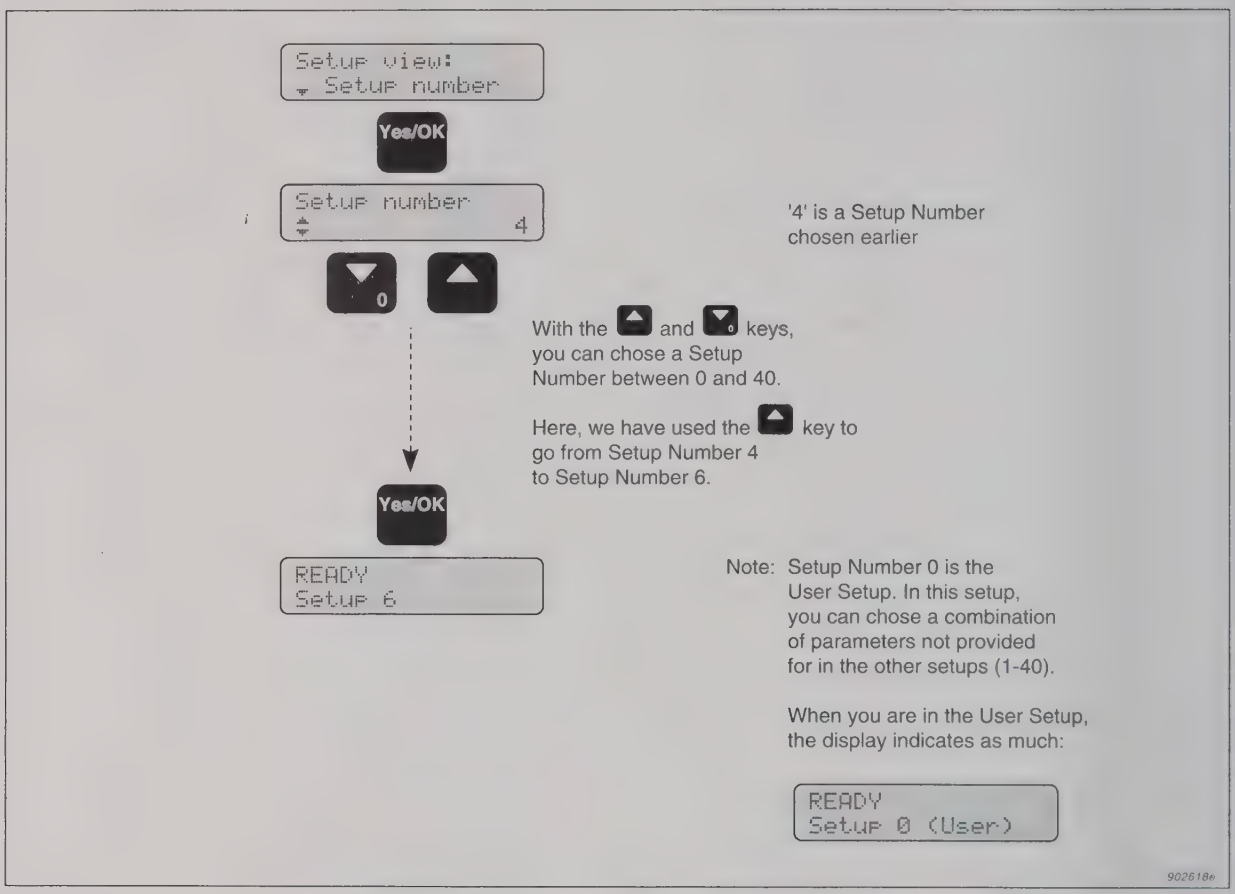

Setup view:
Setup number
Yes/OK
Setup number
4
'4' is a Setup Number chosen earlier
With the and keys, you can chose a Setup Number between 0 and 40.
Here, we have used the key to go from Setup Number 4 to Setup Number 6.
Yes/OK
READY
Setup 6
Note: Setup Number 0 is the User Setup. In this setup, you can chose a combination of parameters not provided for in the other setups (1-40).
When you are in the User Setup, the display indicates as much:
READY
Setup 0 (User)
902618e

Fig. 5.2. Selecting a Setup Number

5.1.2. Selecting the Input and Levels Parameters in User Setup 0

You can select the Input and Level parameters directly only when you are using **User Setup 0** and only when the instrument is in the **READY** mode.

Below, we give the possible settings for each of the parameters in the **Input** and **Levels**. Refer to these when following the instructions given below.

Microphone:	Internal or External
Time Weighting:	Slow or Fast
Peak Filter:	Linear or A
8-hour 100% Level dB:	80, 84, 85 or 90 dB
Threshold dB:	off, 75, 80, 85 or 90 dB
Exchange Rate (q):	3, 4 or 5

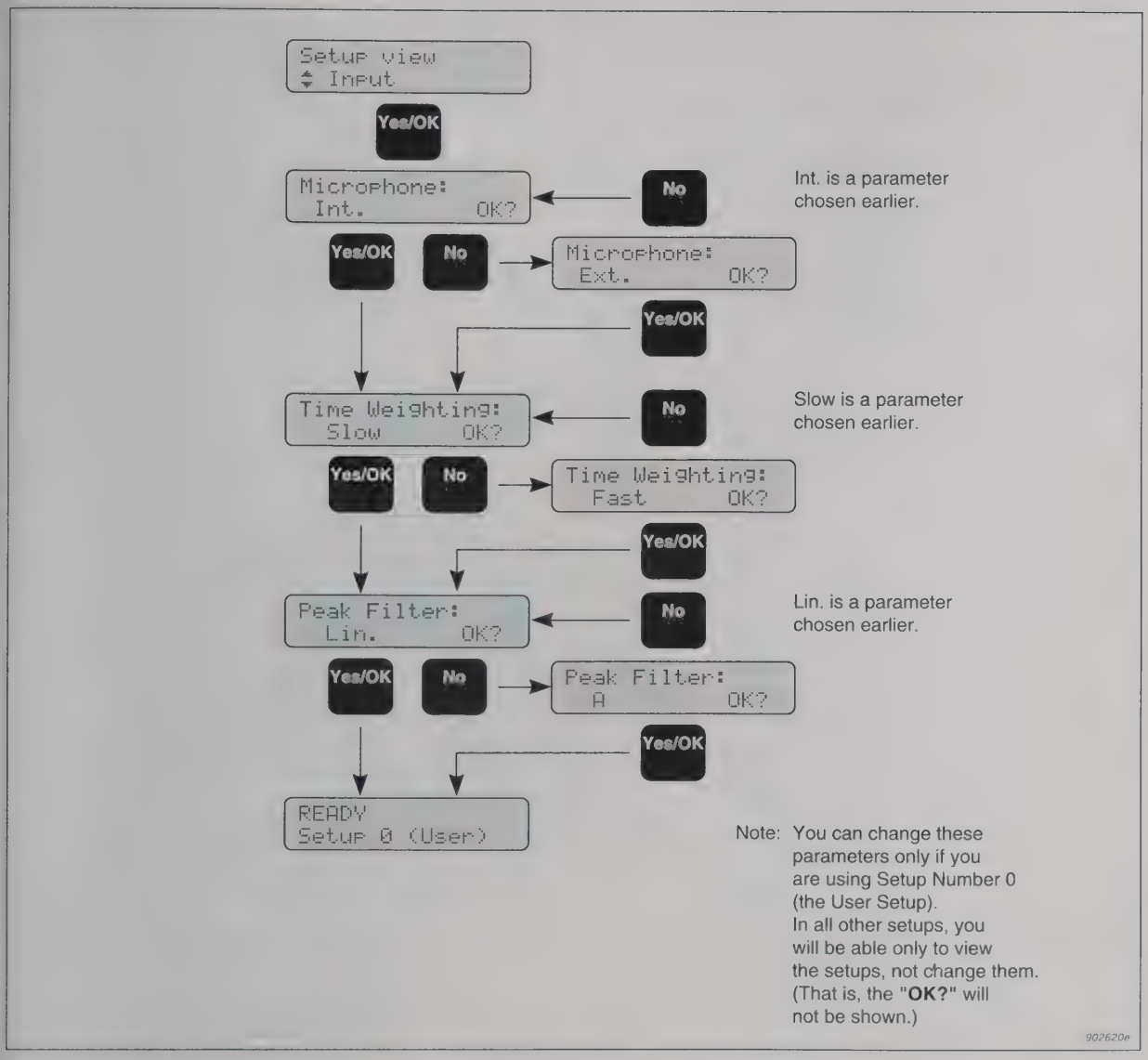


Fig. 5.3. Selecting Input Parameters

The procedure for selecting **Input** and **Levels** parameters follows the same pattern, as given in the following instructions. See also Figs. 5.3 and 5.4.

1. Press **"Setup"**.

2. Use ▼ and ▲ to obtain either the **Input** or **Levels** display.

3. Press **"Yes/OK"**.

   You can now select the kind of microphone that you want (with **Input**) or the 8-hour 100 % Level in dB that you want (with **Levels**).

4. Use ▼ and ▲ to obtain the setting that you want.

The settings are given above – that is, either **Internal** or **External** for **Microphone**, and either **80**, **85** or **90** for **8-hour 100% Level**.

5. Press **"Yes/OK"** when the setting you want is displayed.

   The display will go on to the next option in either the **Input** or **Levels** function.

6. Follow the same procedure to select a setting for the next two options in **Input** and **Levels**.

   When you have selected the settings, the display will automatically return to the **READY** mode.

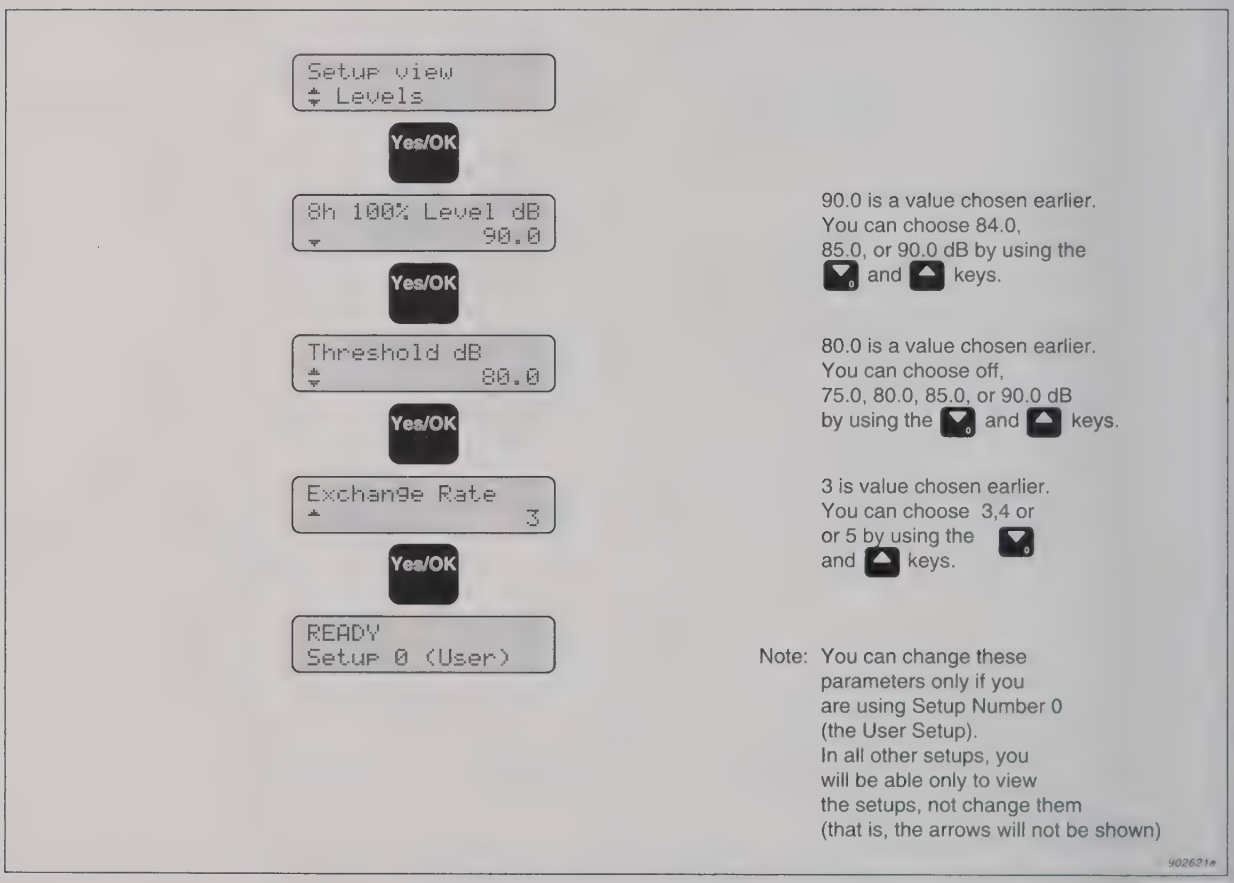

Setup view
Levels
Yes/OK
8h 100% Level dB
90.0
Yes/OK
Threshold dB
80.0
Yes/OK
Exchange Rate
3
Yes/OK
READY
Setup 0 (User)
90.0 is a value chosen earlier. You can choose 84.0, 85.0, or 90.0 dB by using the and keys.
80.0 is a value chosen earlier. You can choose off, 75.0, 80.0, 85.0, or 90.0 dB by using the and keys.
3 is value chosen earlier. You can choose 3,4 or or 5 by using the and keys.
Note: You can change these parameters only if you are using Setup Number 0 (the User Setup). In all other setups, you will be able only to view the setups, not change them (that is, the arrows will not be shown)
902621a

Fig. 5.4. Selecting Levels Parameters

5.2. USING THE OTHER "SETUP" OPTIONS

As well as letting you use the **Setup Number**, **Input** and **Levels** functions, **"Setup"** also gives you access to various other functions which are not affected by a change in Setup number. We shall now describe these.

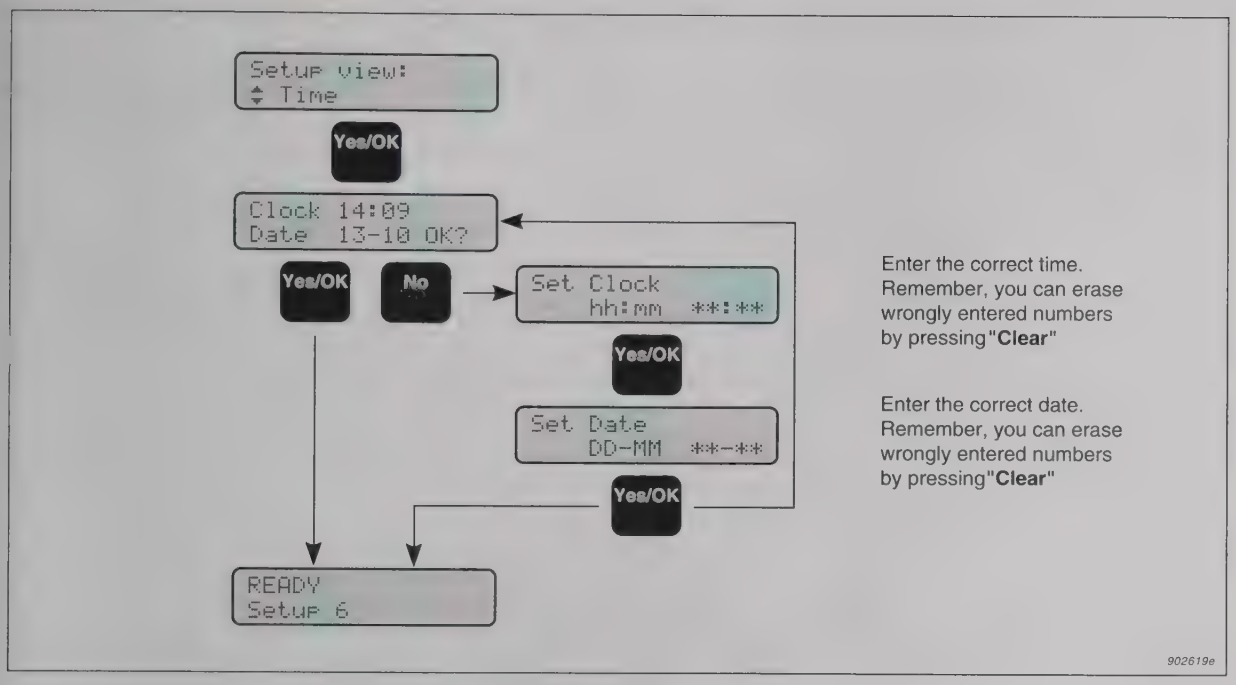


Fig. 5.5. Setting the Time

5.2.1. Setting the Time (See Fig. 5.5)

By using the **Time** function, you can read and change the clock to which the Type 4436 is working. The correct time and date are important when you document your results, as with a printer or computer.

1. Press **"Setup"**.

2. Use the ▼ or ▲ to obtain the display which tells you that you are in the **Time** setup. Press **"Yes/OK"**.

   The display shows you the time of day and the date. The display also asks you if these times are OK. If they are OK, press **"Yes/OK"**. The display returns to the **READY** mode.

   If, however, you wish to enter a new time, do the following:

3. Press **"No"**.

   The display then indicates that you can set the clock (the time of day).

4. Using the numbered pushkeys, key in the hours and then the minutes (**hh:mm**). You have to enter 4 digits. For example, **"0805"** corresponds to five past eight in the morning, and **"2005"** to five past eight in the evening.

5. Press **"Yes/OK"**.

The display then indicates that you can set the date.

6. Using the numbered pushkeys, key in the day of the month, and then the month itself (**DD–MM**). You have to enter 4 digits. For example, **"1007"** corresponds to the tenth of July.

7. Press **"Yes/OK"**.

   The display indicating the Clock and Date should once again appear, showing the new time and date. If these are OK, press **"Yes/OK"**. At exactly this moment, the entered Time and Date become effective. The display returns to the **READY** mode.

   Note: You can erase wrongly entered numbers by pressing **"Clear"**.

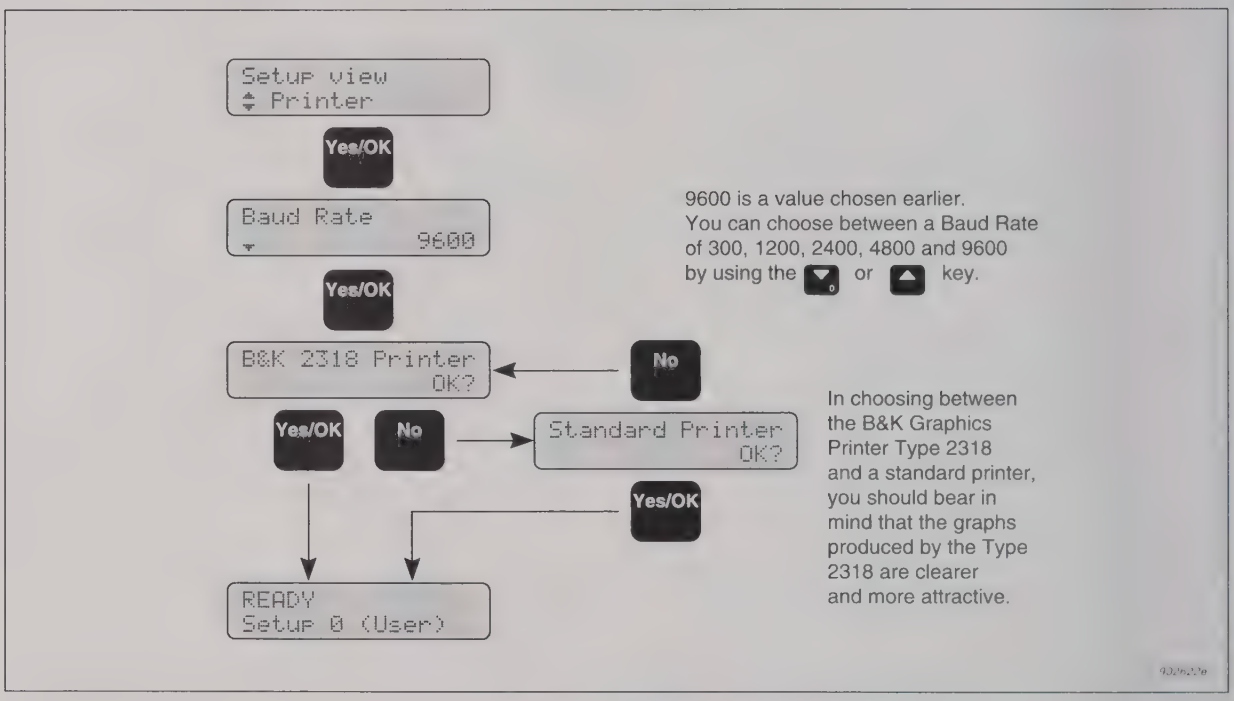


Fig. 5.6. Selecting the Printer Parameters

5.2.2. Selecting the Printer Parameters (see Fig. 5.6)

You can select the Printer parameters in the **READY**, **RUN** or **PAUSE** mode. The **Printer** parameters need to be correct if the Type 4436 is to communicate successfully with a printer (see section 8.1.2).

Selecting a Baud Rate

1. Press **"Setup"**.

2. Use the ▼ or ▲ to obtain the display which tells you that you are in the **Printer** setup. Press **"Yes/OK"**.

The display shows you a particular Baud Rate. In Fig. 5.6, this is **9600**.

3. If this is okay, press **"Yes/OK"**.

4. If, however, a **Baud Rate** of **9600** is not okay, use ▼ to obtain the Baud Rate that you want.

   You have five options in all: **300, 1200, 2400, 4800 and 9600**.

5. When the display shows the Baud Rate that you want, press **"Yes/OK"**.

   Note: The Baud Rates set in the Type 4436 and a printer should be the same. Otherwise, the two instruments cannot communicate (see section 8.1). We recommend that you choose a Baud Rate of 9600 if possible, since this allows the fastest communication between the instruments. Also, when you use one of the three PC output formats, the Type 4436's Baud Rate is automatically set to 9600. After transmission, the Type 4436's Baud Rate automatically returns to what it was before.

Selecting the kind of Printer

When you have selected the Baud Rate, the display shows you a particular kind of printer. In Fig. 5.6, this is **Brüel&Kjær's Graphics Printer Type 2318**.

1. If this is okay, press **"Yes/OK"**.

2. If, however, you do not intend to use the **Type 2318**, press **"No"**.

   The display indicates the **Standard Printer** option (referring to a standard RS 232 printer). You have two options: **Type 2318** or a **Standard Printer**.

3. Press **"Yes/OK"**.

   The display returns to the **READY, RUN** or **PAUSE** mode.

5.2.3. The Self Test Options

The **Self Test** setup lets you check the following features of the Type 4436:

- **memory**
- **display**
- **pushkeys**
- **serial interface**

Because it is not necessary to use the **Self Test** options all that often, we describe how to use them in section 10.2.

6. MAKING MEASUREMENTS

In this chapter, we shall show you how to start and stop measurements both manually and automatically.

Note: Measurements which last more than 24 hours cause memory overflow, resulting in incorrect data.

6.1. STARTING AND STOPPING MEASUREMENTS

6.1.1. Manual Start/Stop

Starting Measurements Manually

The Type 4436 stores measurement data. It retains them even when switched off. But when you start new measurements, the instrument deletes all stored measurement data. Thus, before you use start a new measurement, make sure either that you do not need such data, or that you have recorded it (written it down, or printed it, or transferred it to a computer).

1. Press **"On/Off"** to switch the instrument on.

2. Press **"Run"**.

   The display indicates that it is about to make measurements and then tells you that the instrument is in the **RUN** mode (that is, it is making measurements). The display also tells you what Setup is being used.

Note: When you press **"RUN"** just after switching the instrument on, the display indicates that the instrument is "warming up", which means that its Time Weighting networks are being made ready for measurements. Just wait a few seconds, and the instrument will start making measurements, showing the normal **RUN** display.

Stopping Measurements Manually

There are two ways to stop measurements: you can press **"Pause"** or you can press **"On/Off"**.

Strictly speaking, when you press **"Pause"**, you are not stopping measurements, but merely interrupting them. But you can enter the **Pause** mode to check your measurement results. You can then either continue with your measurements by pressing **"Run"**, or stop them by pressing **"On/Off"**. The instrument then switches off, and retains the measurement data it stored up to the point when you pressed **"Pause"**.

When you press **"On/Off"** during the **RUN** mode, the instrument switches off and retains the measurement data. When you next make measurements, by pressing **"Run"**, all previous measurement data will be deleted. So before you make a new measurement, you should record wanted data by writing it down, printing it or transferring it to a computer.

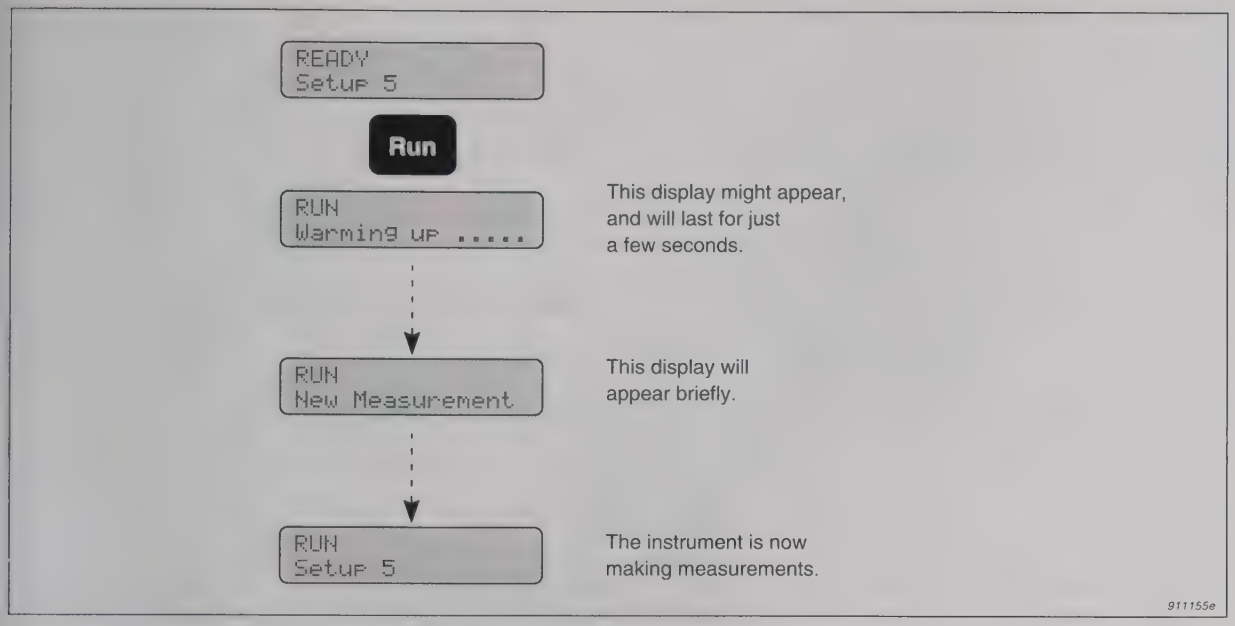


Fig. 6.1. Starting measurements manually

6.1.2. Automatic Start/Stop

The Automatic Start and Stop times can be set while the instrument is in the **READY** mode. While the instrument is in the **RUN** and **PAUSE** modes, you can set the Automatic Stop time, but not the Automatic Start time. You can check the **Auto.** function when either **READY**, **RUN** or **PAUSE** is displayed, or in the **SLM** and **Code** functions.

When you use the **Auto.** function, you set the start time of a measurement period or the stop time of a measurement period, or both. If you have set an Automatic Start time, the instrument starts making measurements when that time is reached. If you have set an Automatic Stop time, the instrument switches itself off when that time is reached. You should set the **Auto.** function before you attach it to the wearer or mount it on a tripod.

Also, if you have set an Automatic Start time, and then switch the instrument off, the Automatic Start time that you set is cancelled. You will need to key in the Automatic Start time again when you next switch the instrument on.

Entering the Auto. Function

1. Press **"Auto"**.

   The display asks you if you want the automatic start and stop options to be off – that is, if you want to start and stop measurements manually. See Fig. 6.2.

2. If you do want to start and stop measurements manually, press **"Yes/OK"**.

   The display returns to **READY**.

3. If, however, you do wish to set an Automatic Start time or an Automatic Stop time (or both), press **"No"**.

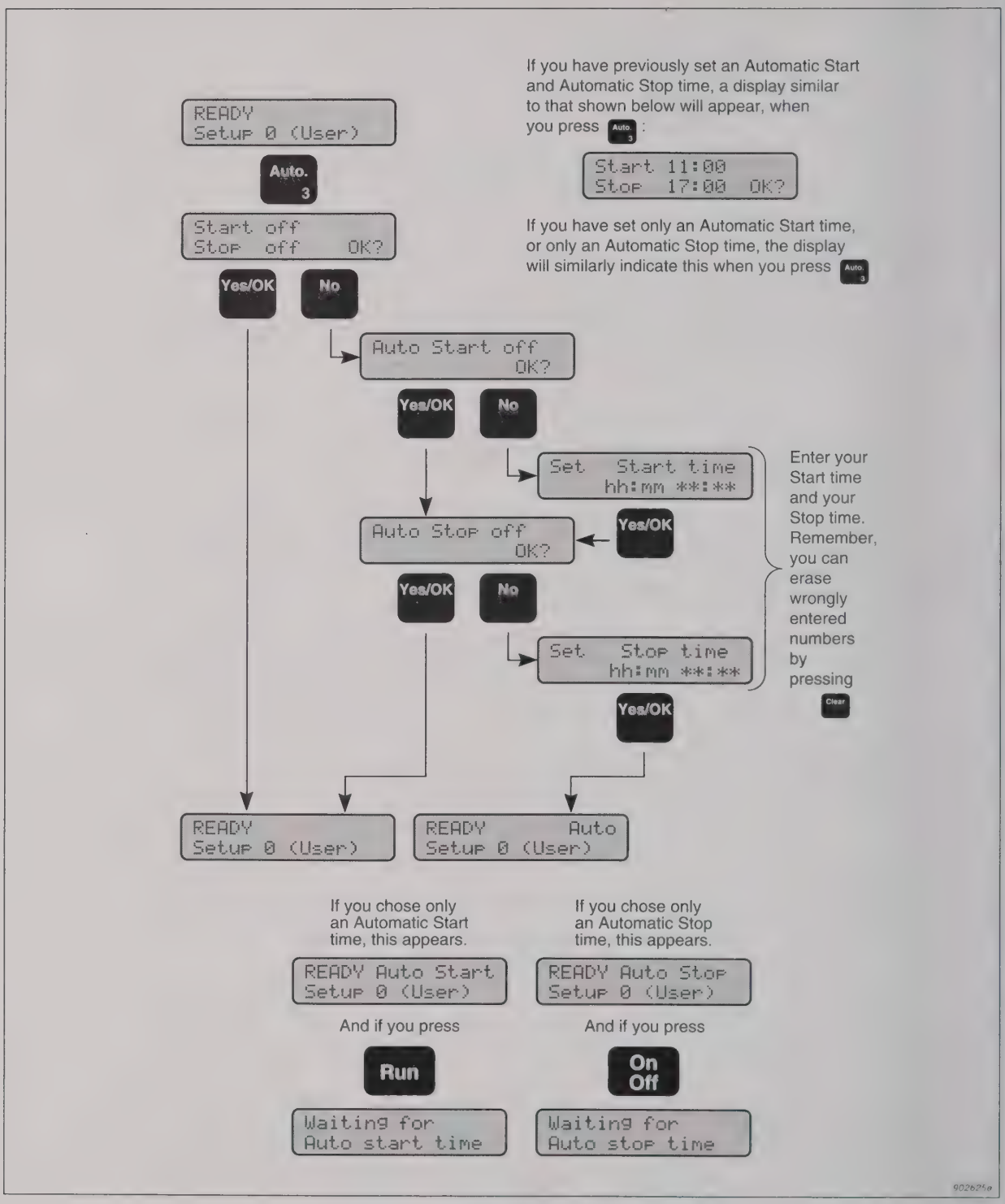

If you have previously set an Automatic Start and Automatic Stop time, a display similar to that shown below will appear, when you press Auto. 3 :
Start 11:00
Stop 17:00 OK?
If you have set only an Automatic Start time, or only an Automatic Stop time, the display will similarly indicate this when you press Auto. 3
READY
Setup 0 (User)
Auto. 3
Start off
Stop off OK?
Yes/OK
No
Auto Start off
OK?
Yes/OK
No
Set Start time
hh:mm **:**
Auto Stop off
OK?
Yes/OK
Yes/OK
No
Set Stop time
hh:mm **:**
Yes/OK
Enter your Start time and your Stop time. Remember, you can erase wrongly entered numbers by pressing Clear
READY
Setup 0 (User)
READY Auto
Setup 0 (User)
If you chose only an Automatic Start time, this appears.
READY Auto Start
Setup 0 (User)
And if you press
Run
Waiting for
Auto start time
If you chose only an Automatic Stop time, this appears.
READY Auto Stop
Setup 0 (User)
And if you press
On Off
Waiting for
Auto stop time

Fig. 6.2. Using the "Auto" function

Setting the Automatic Start Time

When you have confirmed that you wish to use the **Automatic Time** option, the display asks you if you want the Automatic Start option to be off.

1. If you want it to be off (that is, if you want to start measurements manually), press **"Yes/OK"**.

   The display goes to the Automatic Stop time option.

2. If, however, you want measurements to start automatically, you should press **"No"**.

   The display invites you to set the Automatic Start time of measurements. The time is keyed in in hours and minutes (**hh:mm**). Thus, if you key in the numbers **0800**, measurements will start at eight o'clock in the morning. Note that you have to key in four numbers.

   Remember, you can erase wrong numbers by pressing **"Clear"**.

3. When you have keyed in the Automatic Start time that you want, press **"Yes/OK"**.

Setting the Automatic Stop Time

When you have exited the **Automatic Start Time** option, the display asks if you want the Automatic Stop time to be off.

1. If you do want it to be off (that is, if you want to stop measurements manually), press **"Yes/OK".**

   The display returns to **READY**, **RUN** or **PAUSE**.

2. If, however, you want measurements to stop automatically, you should press **"No"**.

   The display invites you to set the Automatic Stop time of measurements. The time is keyed in in hours and minutes (**hh:mm**). Thus, if you key in the numbers **1600**, measurements will end at four o'clock in the afternoon. Note that you have to key in four numbers.

   Remember, you can erase wrong numbers by pressing **"Clear"**.

3. When you have keyed in the Automatic Stop time that you want, press **"Yes/OK"**.

   The display returns to **READY**, **RUN** or **PAUSE**. The display indicates which of the **"Auto."** options you chose: **"Auto start", "Auto stop" or "Auto"** (when you have set both).

6.1.3. Performing Automatic Measurements

In the example given in section 6.1.2, the instrument will automatically start making measurements (at eight o'clock in the morning) and will automatically stop making measurements (at four o'clock in the afternoon).

Remember, the instrument must be on at the time of Automatic Start. When the Automatic Start time is reached, the display changes to **RUN** (i.e. the instrument is making measurements), and indicates that the instrument is now waiting for the Automatic Stop.

If you try to enter the **RUN** mode before an automatically timed measurement has started, the display tells you that you cannot do this because the instrument is waiting for the Automatic Start time to be reached. Fig. 6.2 (at the bottom left) shows the display that appears in this case.

If you try to switch the instrument **off** during a measurement where the Automatic Stop time is being used, the display tells you that you cannot do this because the instrument is waiting for the Automatic Stop time to be reached. Fig. 6.2 (at the bottom right) shows the display that appears in this case. However, you can of course switch off the **Auto. Stop time**, and then stop measurements manually.

Note: When the Automatic Stop time is reached, the display indicates that measurements are ending, and blinks ten times. Then the display tells you that the instrument is about to switch itself off. This display blinks five times and then the instrument switches itself off. The Type 4436 retains its measurement data as usual.

6.2. DISABLING THE PUSHKEYS

The **Code** function lets you temporarily disable the pushkeys of the Type 4436. This is a useful function in circumstances where the keys of the instrument might accidentally be pushed during measurements. The **Code** function also de-activates the display of the Type 4436. To re-activate the pushkeys and display of the Type 4436, you have to key in a code and then press **"Yes/OK"**.

6.2.1. Using the Code Function to Disable the Pushkeys

Press **"Code"**. The display blinks five times, and then four asterisks appear on the display. See Fig. 6.3. Neither the pushkeys nor the display function any longer, but measurements continue, and if an Automatic Start and Stop time have been set, measurements will start and stop at those times. The pushkeys and the display will not function again until you key in the four-figure code.

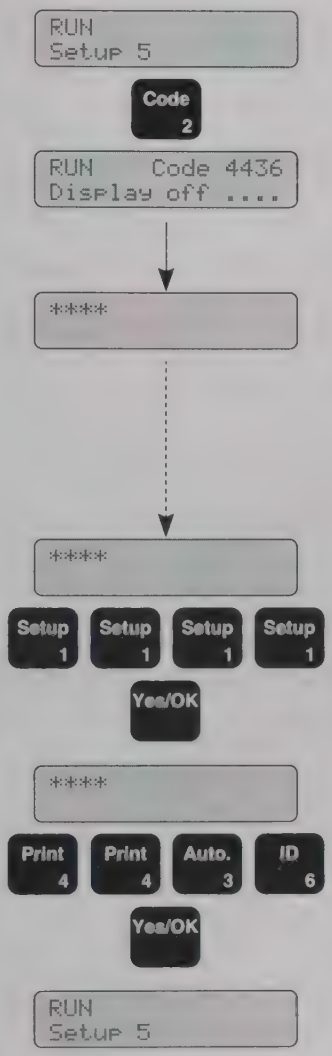
6.2.2. "Unlocking" the Disabled Keys

1. Press **"Clear"** to erase any numbers which might have been keyed in accidentally.

2. Key in the four numbers **4436** (the display does not show the numbers as you key them in).

3. Press **"Yes/OK"**.

   When this is done, the pushkeys and the display return to their normal state. See Fig. 6.3. No other 4-figure numbers "unlock" the pushkeys and the display.



The lower line in the display will blink 5 times . . . . .

. . . . . then the display goes blank, but for 4 asterisks.

The Type 4436 is still in RUN, still making measurements, but the pushkeys have been disabled.

The keys remain disabled until you enter '4436' and press **"Yes/OK"** Any other number will have no effect. If, for example, you try '1111', and press **"Yes/OK"** nothing happens.

Remember, you can erase wrongty entered numbers by pressing "Clear"

'4436' will return the display to what it was before you pressed **"Code"** The keys will now respond to pushes.

902627e

Fig. 6.3. Using the "Code" function

7. READING MEASUREMENT RESULTS

In this chapter, we shall show you how to read results from the display of the Type 4436. The results we shall discuss are as follows:

- Noise Dose (section 7.1)
- Noise Levels (section 7.2)
- Statistics (section 7.3)
- SPL and Peak Values (section 7.4)

Note: When you look at Dose, Noise Levels or Statistics results, they all refer back to the moment when you pressed the particular function key (**"Dose"**, **"Level"** or **"Stats."**). If you want to look at updated **Dose** and **Level** results, you should keep pressing **"Dose"** or **"Level"** while viewing a particular parameter. You cannot obtain updated Statistics results in this way.

7.1. NOISE DOSE

7.1.1. Noise Dose Results

When you use the **Dose** function, you can display any one of six noise dose parameters. These parameters are simply different ways of expressing noise dose, and apply to your current measurement period, be it completed or not. The parameters you can view in **Dose** are listed below.

- **Dose %**
- **8h Dose %**
- **Sound exposure Pa^2h**
- **8h Sound exposure Pa^2h**
- **$L_{EP,d}$**
- **PSEL**

If you have chosen a Setup in which the exchange rate (see section 5.1) is 4 or 5, you can obtain only the first two noise dose parameters (Dose % and 8h Dose %). This is because with an exchange rate of 4 or 5, it is not the L_{eq} which is calculated, but the L_{av}, and since the last four parameters are derived from the L_{eq}, they are therefore unavailable.

Note: If you change the Exchange Rate while you are reading results (that is, by changing the setup number or, if using **User Setup 0**, by changing the Exchange Rate directly), all results derived from the L_{eq} or L_{av} will be wrong. Thus, you should use the same setup when reading results as you did when making them.

7.1.2. Reading Dose Results

You can read Noise Dose results in either the **READY**, **RUN** or **PAUSE** mode. The basic procedure for obtaining and reading **Dose** results is as follows:

1. Press **"Dose"**
2. Use ▼ or ▲ to scroll through the **Dose** results until the display shows the one that you want.
3. Press **"Dose"** if you want to read updated values of the displayed result.
4. Press **"Yes/OK"** when you want to exit the **Dose** function.

   The display will return to **READY**, **RUN** or **PAUSE**.

We shall now describe the **Dose** parameters in turn. You should note that the measurement results in Fig. 7.1 are not meant to be realistic. They simply indicate that measurement values can sometimes run into four figures.

Dose %

Dose % represents is the amount of sound energy received by a worker, expressed as a percentage of the daily allowed dose (100 % level). With the Type 4436, the display range for the **Dose %** is from 0 to 9999 %.

Any **Dose %** value of more than **100** (accumulated during a working day) suggests that the worker is being exposed to too much noise. Fig. 7.1 shows a **Dose %** of **1234**. If the **Dose %** value is excessive, measures must be taken – the noise levels must be reduced, the exposure time must be reduced, ear protectors should be supplied, etc. For more information, see section 11.3.

8h Dose %

8h Dose % represents the **Dose %** extrapolated to a period of eight hours. In locations where noise levels are relatively constant during a working day the **8h Dose %** option, lets you make short-term measurements, so you can get an indication of what the **Dose %** would have been, had you kept the Type 4436 switched on for eight hours. The **8h 100% Level dB** can be either 80, 84, 85 or 90 dB (see section 5.1.2). With the Type 4436, the display range for the **8h Dose %** is from 0 % to 9999 %. Fig. 7.1 shows an **8h Dose %** of 2345. For information about what should be done in the event of excessive noise dose, see section 11.3.

Note: When you start a measurement, extrapolated Dose values take a few seconds to settle.

Sound Exposure Pa^2h

Sound Exposure Pa^2h (Pascal Squared Hours) represents the amount of sound energy received by a worker. It is a parameter recommended by the IEC, Technical Committee No. 29, May 1990 and is expressed in Pa^2h (Pascal squared hours). With the Type 4436, the display range for the **Sound Exposure Pa^2h** is from 0.00 to 99.99. Fig. 7.1 shows a **Sound Exposure Pa^2h** of 34.56. For information about what should be done in the event of excessive noise dose, see section 11.3.

The **Sound Exposure Pa²h** is recommended by the IEC, Technical Committee No. 29, May 1990. This parameter is more fully described in section 11.3.

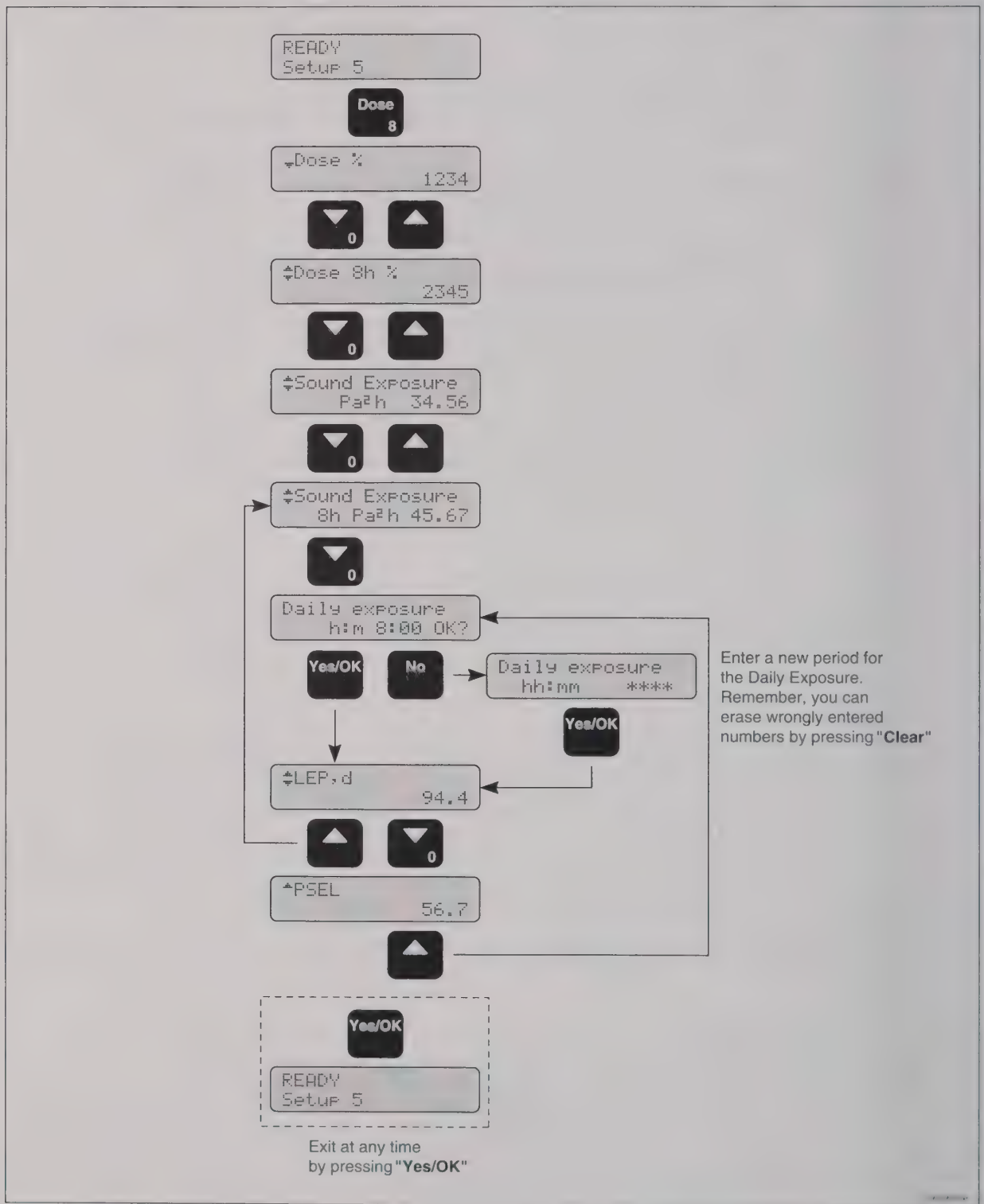


Fig. 7.1. Using the "Dose" function

Sound Exposure 8 h Pa^2h

Sound Exposure 8 h Pa^2h represents the **Sound Exposure Pa^2h** extrapolated to a period of eight hours. In locations where the noise levels are relatively constant during a working day the **Sound Exposure 8 h Pa^2h** option lets you make short-term measurements, so you can get an indication of what the **Sound Exposure Pa^2h** would have been, had you kept the Type 4436 switched on for eight hours. With the Type 4436, the display range for the **8 h Pa^2h** is from 0.00 to 99.99. Fig. 7.1 shows a **8 h Pa^2h** of 45.67. For information about what should be done in the event of excessive noise dose, see section 11.3.

Note: When you start a measurement, extrapolated Dose values take a few seconds to settle.

$L_{EP,d}$

$L_{EP,d}$ (Daily Personal Noise Exposure) is a parameter recommended by the European Communities Directive 86/188/EC of 12 May 1986 (see section 11.3). It is derived from the L_{eq}, the daily duration of a worker's exposure to noise and the A-weighted sound pressure in Pascals to which a worker is exposed.

If you want to read the **$L_{EP,d}$** (Daily Personal Noise Exposure), you must inform the Type 4436 what exposure period the **$L_{EP,d}$** is to be based upon. The display first of all asks if the exposure period is to be eight hours. You should then do the following:

1. Press **"Yes/OK"** if an exposure period of eight hours is OK.

   The display will show the **$L_{EP,d}$**.

2. If, however, you do not want the **$L_{EP,d}$** to be based upon an eight hour daily exposure period, press **"No"**.

   A new display lets you enter a daily exposure period, which is taken as the time upon which you want your **$L_{EP,d}$** calculations to be based.

3. Key in this new time. For example, if you enter the numbers **0730,** the **$L_{EP,d}$** will be based upon a daily exposure period of seven hours and thirty minutes.

   Remember, you can erase wrong numbers by pressing **"Clear"**.

4. When you have entered the time period that you want, press **"Yes/OK"**.

   The **$L_{EP,d}$** for your measurement period is now displayed. With the Type 4436, the display range for the **$L_{EP,d}$** display range is from 3.2 dB to 154.8 dB. Fig. 7.1 shows a **$L_{EP,d}$** of 94.4 dB.

   Note: If you enter a daily exposure period of your own, the instrument retains that period either until you change it or until you switch the instrument off (when the instrument resets the Daily Exposure time to the default value of eight hours).

PSEL

The **PSEL** (**Personal Sound Exposure Level**) represents the constant sound level which, if maintained for eight hours, would deliver the same A-weighted noise energy as that delivered during the actual exposure period. It is similar to the **SEL**, which is the constant sound level which, if maintained for *one second*, would deliver the same A-weighted noise energy as that delivered during the actual noise exposure period (see section 11.4). With the Type 4436, the display range for the **PSEL** 30.0 dB to 999.9 dB. Fig. 7.1 shows a **PSEL** of 56.7 dB.

7.2. NOISE LEVEL

7.2.1. Noise Level Results

When you use the **Level** function, you can display any one of six noise level parameters. These parameters are simply different ways of expressing noise level, and apply to your current measurement period, be it completed or not. You can view the following parameters in the **Level** option.

- **L_{eq}** (or **L_{av}**)
- **140dB Peak Exceeded**
- **115dB SPL Exceeded**
- **MaxL**
- **MaxP**
- **SEL**

If you have chosen a Setup in which the exchange rate is 4 or 5 (see section 5.1), you cannot obtain the **L_{eq}** or the **SEL**. This is because with an exchange rate of 4 or 5, it is not the **L_{eq}** which is calculated, but the **L_{av}** (the average sound level for the measurement period), and since the **SEL** is derived only from the **L_{eq}**, it is therefore unavailable.

Note: If you change the Exchange Rate while you are reading results (that is, by changing the setup number or, if using **User Setup 0**, by changing the Exchange Rate directly), all results derived from the L_{eq} or L_{av} will be wrong. Thus, you should use the same setup when reading results as you did when making them.

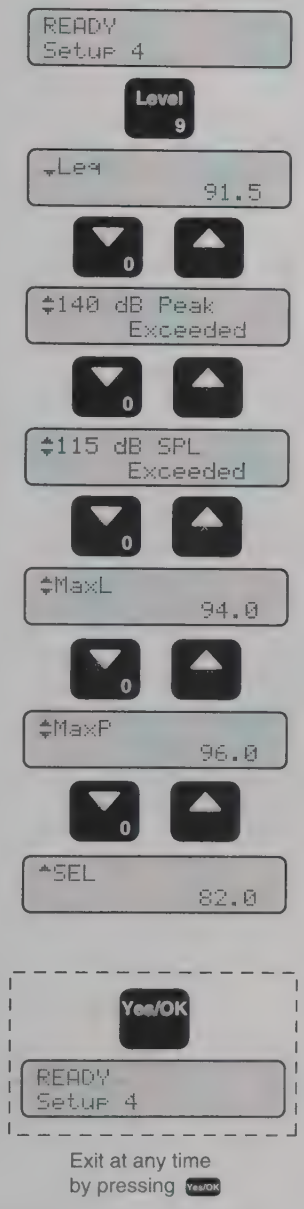
7.2.2. Reading Level Results

You can read Noise Level results in either the **READY**, **RUN** or **PAUSE** mode. The basic procedure for obtaining and reading **Level** results is as follows:

1. Press **"Level"**
2. Use ▼ or ▲ to scroll through the **Level** results until the display shows the one that you want.
3. Press **"Level"** if you want to read updated values of the displayed result.
4. Press **"Yes/OK"** when you want to exit the **Level** function.

   The display will return to **READY**, **RUN** or **PAUSE**.

We shall now describe the **Level** parameters in turn.



Leq for the measurement period. If you have chosen an Exchange Rate of either 4 or 5, the display will show Lav instead of Leq. Lav is the average Sound Pressure Level for the measurement period.

Fig. 7.2. Using the "Level" function

L_{eq} or L_{av}

L_{eq} (**Equivalent Continuous Sound Level**) represents the mean energy of sound levels averaged over a measurement period – that is, it is the continuous steady noise level which would have the same acoustic energy as the actual, fluctuating noise levels measured over the same period of time. With the Type 4436, the display range of the **L_{eq}** is from 30.0 dB to 150.0 dB. Fig. 7.2 shows a **L_{eq}** of 91.5 dB. If the Threshold Level you have selected is higher than the measured sound levels, the instrument will not register a L_{eq} value (because the L_{eq} is derived from recorded sound levels). In such an instance, the display shows four dashes beside "**L_{eq}**". That is: **----**.

Note: If you have set the Exchange Rate to 4 or 5 (see section 5.1), the display shows the L_{av} (the **Average Sound Level** for the measurement period).

140dB Peak Exceeded?

The display indicates either that the 140 dB Peak has been exceeded in the current measurement period, or that it has not been exceeded. In Fig. 7.2, it has been exceeded.

115dB SPL Exceeded?

The display indicates either that the 115 dB SPL has been exceeded in the current measurement period, or that it has not been exceeded. In Fig. 7.2, it has been exceeded.

MaxL

This is the **Maximum Sound Pressure Level** for the measurement period. With the Type 4436, the display range for the **MaxL** is from 30.0 dB to 150.0 dB. Fig. 7.2 shows a **MaxL** of 94.0 dB.

MaxP

This is the **Maximum Peak Level** for the measurement period. With the Type 4436, the display range for the **MaxP** is from 30.0 dB to 150.0 dB. Fig. 7.2 shows a **MaxP** of 96.0 dB.

SEL

SEL (**Sound Exposure Level**) represents the constant sound level which, if lasting for one second, would deliver the same amount of acoustical energy as that delivered over the entire measurement period. With the Type 4436, the display range for the **SEL** is from 30.0 dB to 999.9 dB. Fig. 7.2 shows a **SEL** of **82.0dB**.

7.3. STATISTICS

7.3.1. Statistical Results

The Type 4436 can work out the statistical distribution of noise levels over the measurement period. This distribution is based on 1-second SPL values. The Type 4436 can display the **Distribution** and the **Cumulative Distribution**. Statistical information can be read from the display or transferred to a printer or computer. For examples of graphical and tabular print-outs of the Distribution and Cumulative Distribution, see section 8.2.3. We shall now briefly describe the **Distribution** and **Cumulative Distribution** in turn.

Distribution:

This shows, in percentage terms, the prevalence of noise levels measured over a period of time. Fig. 7.3 shows that for **4.2%** of the measurement period, the sound level was **105** (to 105.9 dB). The Level Interval in this instance was **1dB,** so the calculations are based on sound levels taken in 1 dB steps (**105** (to 105.9)**dB**), **106** (to 106.9)**dB**, and so on). If you had chosen a Level Interval of **5dB**, the calculations would have been based on sound levels taken in 5 dB steps (**95** (to 99.9)**dB**, **100** (**to 104.9**)**dB**, **105** (to 109.9)**dB**, and so on).

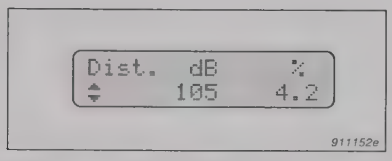


Fig. 7.3. The Distribution display

Cumulative Distribution:

This shows what percentage of all the measured noise levels came above a certain noise level. Fig. 7.4 shows that for **5.0%** of the measurement period, the sound level was **105dB** and above. The Level Interval in this instance was **1dB**, so the calculations are based on sound levels taken in 1 dB steps (**105** (to 105.9)**dB**, **106** (**to 106.9**)**dB** and so on). If you had chosen a Level Interval of **5dB**, the calculations would have been based on sound levels taken in 5 dB steps (**95** (to 99.9)**dB**, **100** (to 104.9)**dB**, **105** (to 109.9)**dB** and so on).

Note: The **Distribution** and **Cumulative Distribution** have a time limit of 18 hours within each 1 dB level class. In the unlikely event of more than 18 hours being spent at the same level, distribution results will be faulty.

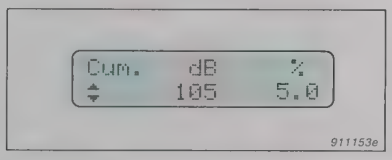


Fig. 7.4. The Cumulative Distribution display

7.3.2. Reading Statistical Results

You can read Statistical results in either the **READY**, **RUN** or **PAUSE** mode. The basic procedure for obtaining and reading Statistical results is as follows (see Fig. 7.5):

1. Press **"Stats."**

   The display asks if you want to read **Distribution** results.

2. Press **"Yes/OK"** if you want to read the **Distribution** results, or press **"No"** and then **"Yes/OK"** if you want to read the **Cumulative Distribution** results.

   The display asks if you want the **Level Interval** to be 5 dB. This means that you can view Statistical data at, for example, 70 dB, then 75 dB, then 80 dB, and so on, at 5 dB intervals.

3. Press **"Yes/OK"** if you want the **Level Interval** to be 5 dB, or press **"No"** and then **"Yes/OK"** if you want the **Level Interval** to be 1 dB.

   The display indicates that the Type 4436 is calculating the statistical information that you want. When it has finished the calculations, the display shows the statistical information, starting with the lowest dB level at which sounds were recorded.

4. Use ▼ and ▲ to view the **Distribution** or **Cumulative Distribution** at other dB levels. If you keep pressing one of these keys, you can scroll through the various readings quickly.

5. Press **"Yes/OK"** when you are finished reading Statistical results.

   The display returns to **READY**, **RUN** or **PAUSE**.

Note: Because the percentage figures in Statistical results are rounded to the first decimal place, accumulated percentages do not necessarily equal 100 %.

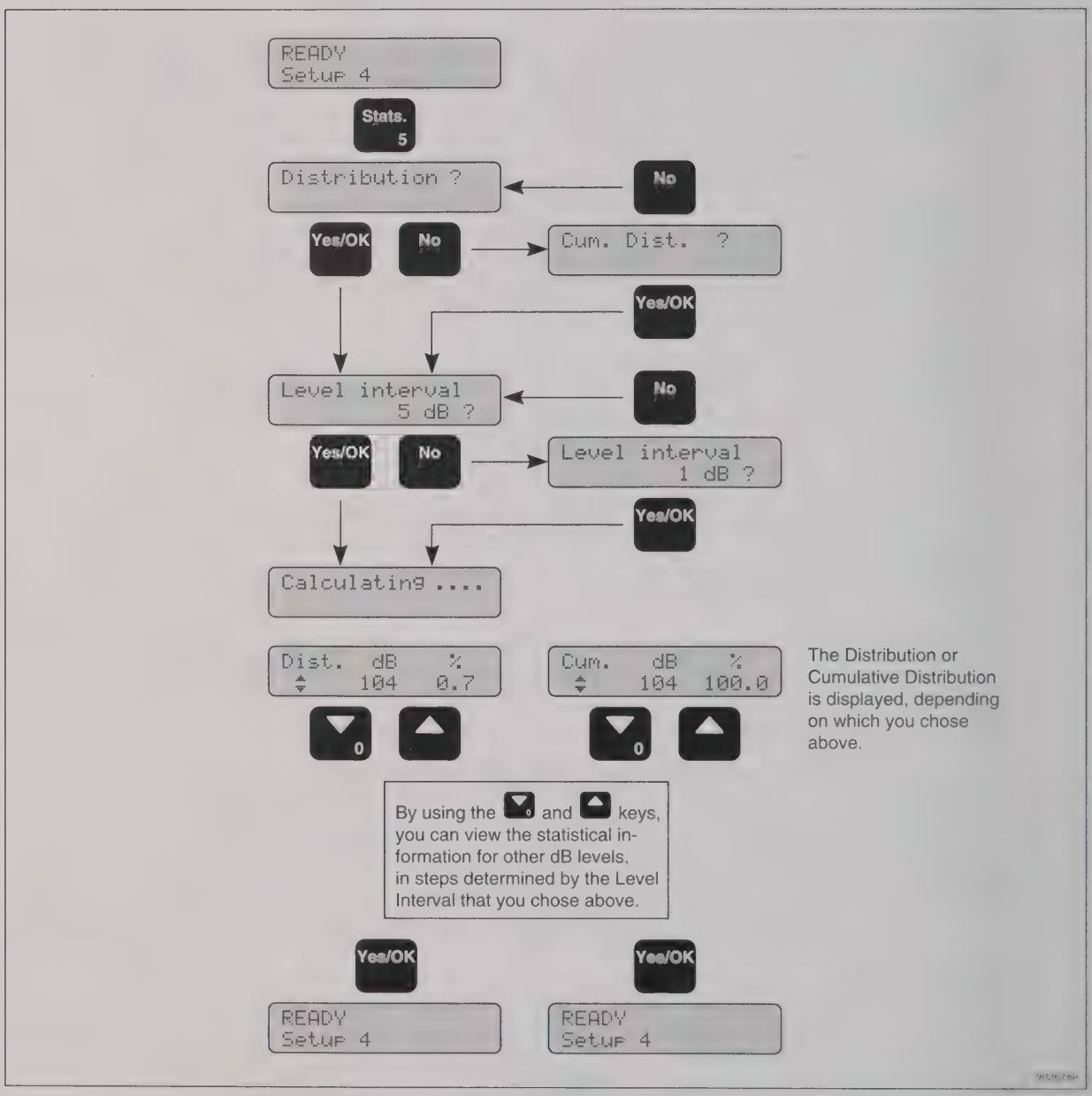


Fig. 7.5. Using the "Statistics" function

7.4. SPL AND PEAK

7.4.1. SPL and Peak Results

You can read **SPL** and **Peak** values only in the **RUN** and **PAUSE** modes. You cannot read **SPL** and **Peak** values in the **READY** mode.

The **SLM** function lets you measure two parameters: the Sound Pressure Level (**SPL**) and the **Peak** value. These parameters are updated every second. The **SPL** is measured using either a **Fast** or **Slow Time Weighting**, and an **A Frequency Weighting**. The **Peak** value is measured using either **A** or **Lin. Frequency Weighting**. The weightings used depend on the current setup of the Type 4436. See section 5.1.

Fig. 7.6 shows a SPL value with **Slow** Time Weighting, and a Peak value with **Lin.** Frequency Weighting.

Note: If you intend to use the Type 4436 solely as a sound level meter, you should use the supplied SLM Adaptor, which keeps the rubber tube (or a preamplifier) in a fixed position during measurements. To find out how to attach the SLM Adaptor to the instrument, see section 4.2.2.

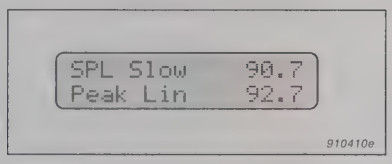


Fig. 7.6. The "SLM" display

7.4.2. Reading SPL and Peak Results

1. Press **"SLM"**.

   The display shows the current Sound Pressure Level – RMS (A) – and the current Peak value. These are updated every second. One of the Type 4436's two detectors measures the RMS (A) with either a **Slow** or **Fast** Time Weighting. The other detector measures the Peak signal with either an **A** or **Lin.** Frequency Weighting.

2. Press **"Yes/OK"** when you want to get out of the **SLM** function.

   The display returns to **RUN** or **PAUSE**.

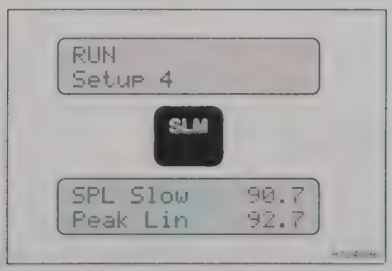


Fig. 7.7. Using the "SLM" function

8. PRINTING MEASUREMENT RESULTS

You can use the Type 4436 with Brüel & Kjær's Graphics Printer Type 2318 (with Serial Interface Module ZI 0054), or with a standard RS 232 printer. Typically, the print-outs obtained with Type 2318 Graphics Printer are more elegant than those obtained with other printers.

We shall now describe how to set up the Type 4436 with, first, the Type 2318, and then with a standard RS 232 printer. After that, we shall deal, in turn, with each print-out option – **Status**, **History** and **Statistics**. At the end of the chapter, we shall show you how to mark your print-outs with an ID (Identification) number.

8.1. PREPARING THE TYPE 4436 AND A PRINTER FOR DATA TRANSFER

8.1.1. Making Sure that Type 4436 and a Printer Can Communicate

To make sure that the Type 4436 and a printer can communicate, you have to configure both pieces of equipment. To do this, see the following instructions.

1. Inform the Type 4436 what Baud Rate and kind of printer you want to use. To do this, press "**Setup**" and select the **Printer** Setup. For more about this, see section 5.2.2.

2. Refer to your printer's Instruction Manual, and set the following configurations:

   - **Baud rate = Type 4436's** (see Note)
   - **8 Databits**
   - **No Parity**
   - **1 Stopbit**

   Note: Printouts can be obtained in either the **READY** or **PAUSE** mode (at any selectable Baud rate). In the **RUN** mode the Baud rate has to be 9600 in order for the Type 4436 both to make measurements and send data to the printer.

8.1.2. Connecting the Type 4436 to a Printer

Before connecting the Type 4436 to a printer, both instruments should be switched ON or both instruments should be switched OFF. When you are finished using the Type 4436 with a printer, switch the printer OFF (or disconnect it from the Type 4436) *before* switching the Type 4436 off.

When connecting the Type 4436 to printers which have 5-pin Digital Input sockets, use Interface Cable AO 0299 (see Figs. 8.1 and 8.2). For Printers with 25-pin Digital Input sockets, use Interface Cables AO 0299 and AO 0335 (5-pin/25-pin). If your printer has a 9-pin Digital Output socket, use a 5-pin/9-pin interface cable. If you do not have one of these, wire a 9-pin cable to Interface Cable AO 0299 in accordance with the pin-designations given in Fig. 8.3.

Interface Cable AO 0299 attaches to the Digital Output socket of the Type 4436, which is shown in Fig. 3.3. Attach the cable gently.

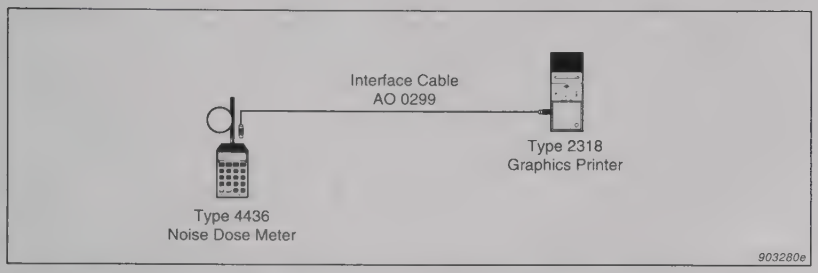


Fig. 8.1. Connecting the Noise Dose Meter to the Graphics Printer Type 2318

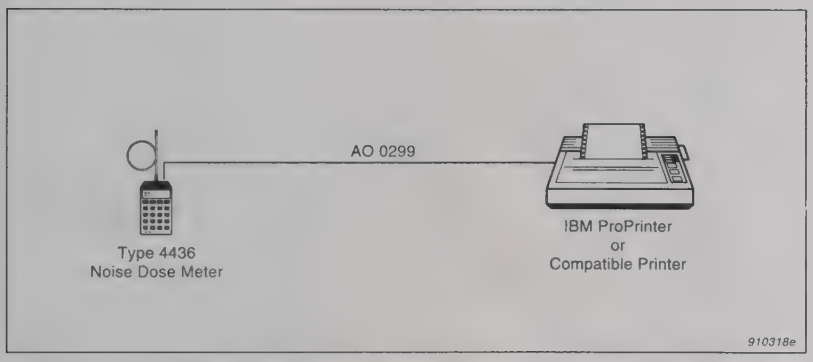


Fig. 8.2. Connecting the Noise Dose Meter to a standard RS 232 printer

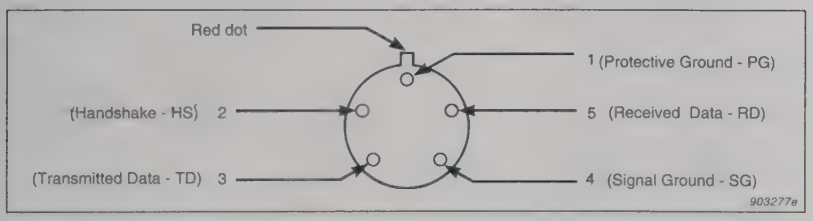


Fig. 8.3. The pin designations on Interface Cable AO 0299

8.2. TRANSFERRING DATA FROM THE TYPE 4436 TO A PRINTER

You can print measurement data in either the **READY**, **RUN** or **PAUSE** mode.

Having connected the Type 4436 to a printer, you can now select any one of three following digital output options, which are available in the **Print** function (see Fig. 8.4):

- **Status**
- **History**
- **Statistics**

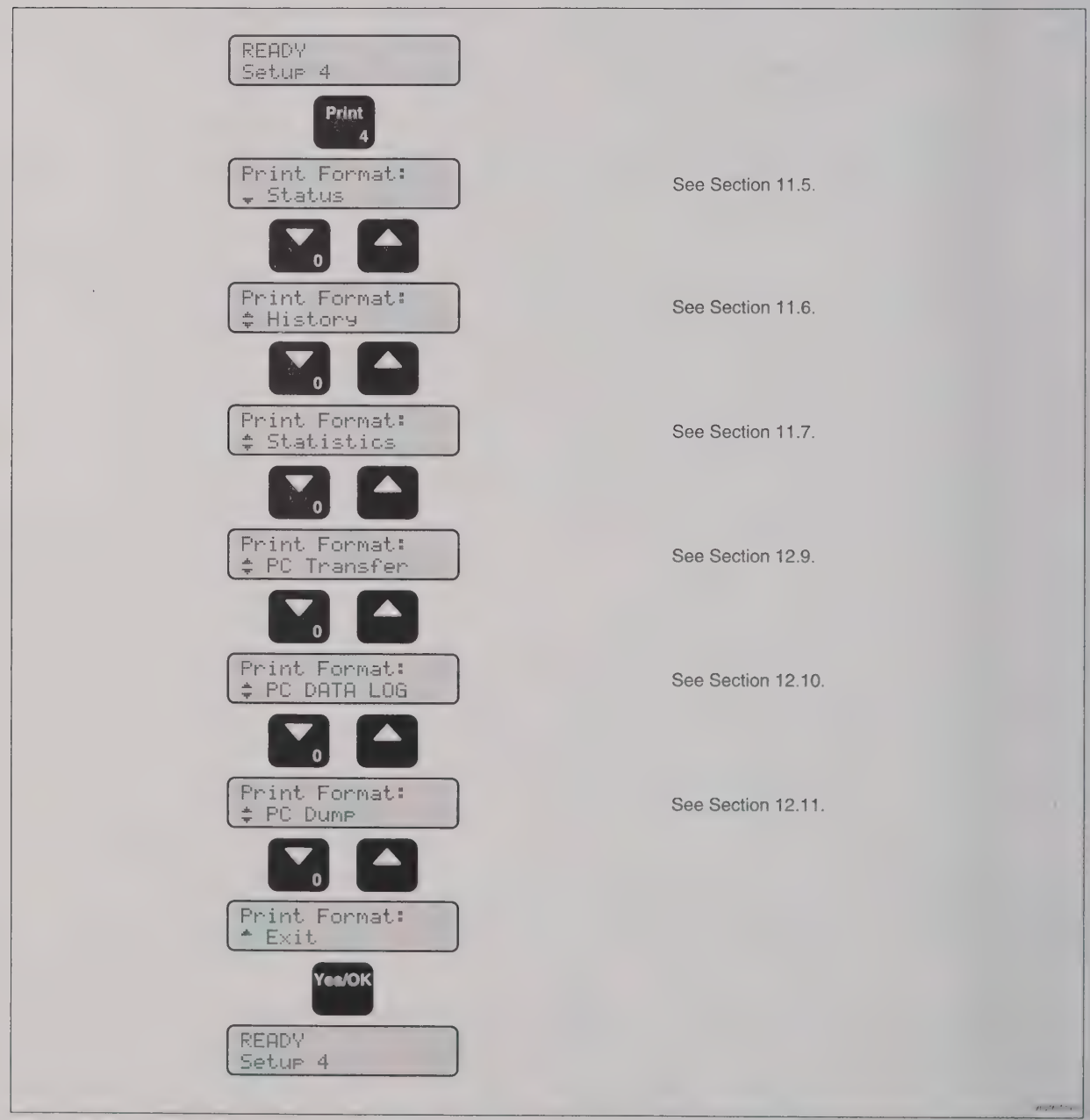


Fig. 8.4. Using the Print function

8.2.1. Printing the Status

Status print-outs give information about the Type 4436's general status, the setup, various time indicators, dose results and level results. Fig. 8.6 shows an example **Status** print-out made with the Type 4436 and the Type 2318 Graphics Printer.

1. Press **"Print"**. The display indicates that it is in the **Print** function. See Fig. 8.5.
2. Use ▼ or ▲ to scroll through the options until you obtain the **Status** option.
3. Press **"Yes/OK"**.

   The display indicates that printing is in progress. When the Type 4436 has transferred its data to the printer, its display returns to either **READY**, **RUN** or **PAUSE**.

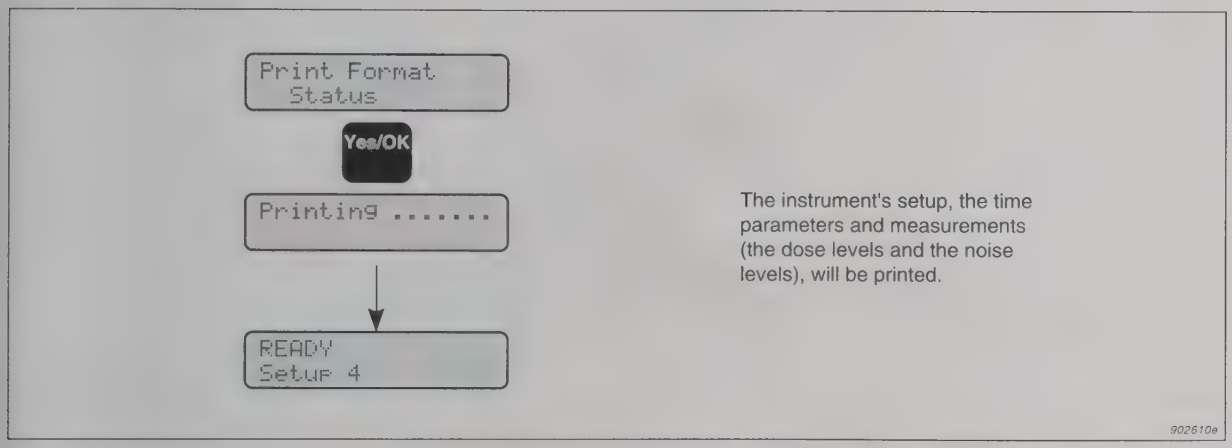


Fig. 8.5. Printing the Status

8.2.2. Printing the History

The History is a record of 1-minute L_{eq}, MaxL and MaxP values. It is available through the Digital Output, but cannot be read from the display of the Type 4436. When you print the History, it can be in the form of a table or graph, at 1-minute or 10-minute intervals. Fig. 8.8 shows a tabular print-out of a measurement history, at 10-minute intervals. Fig. 8.9 shows a graphical print-out of the History, at 1-minute intervals. Both these print-outs were made with the Type 4436 and the Type 2318 Graphics Printer.

BRÜEL & KJÆR
Dose Meter Type 4436

Date D-M	25-01
Clock h:m	13:50
ID number	1
Remarks	
Auto start	off
Auto stop	off
Baud Rate	1200
Battery V	8.1
Cal. Adjustment dB	2.8
Setup number	1
Microphone	Int.
Time Weighting	Slow
Peak Filter	Lin.
8h 100% Level dB	85.0
Threshold	off
Exchange Rate	3
Start	12:28
End	13:49
Run	1:19
Pause	0:02
Overload h:m:s	00:00:00
Dose %	796
Dose 8h %	4798
Sound Exp. Pa2h	8.05
Sound Exp. 8h Pa2h	48.60
Daily exposure h:m	8:00
LEP,d	101.7
PSEL	93.8
Leq	101.7
140 dB Peak	Exceeded
115 dB SPL	Exceeded
MaxL	147.3
MaxP	152.0
SEL	138.4

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Fig. 8.6. An example Status print-out

Choosing the History option

1. Press **"Print"**. The display indicates that it is in the **Print** function. See Fig. 8.7.
2. Use ▼ or ▲ to scroll through the options until you obtain the **History** option.
3. Press **"Yes/OK"**

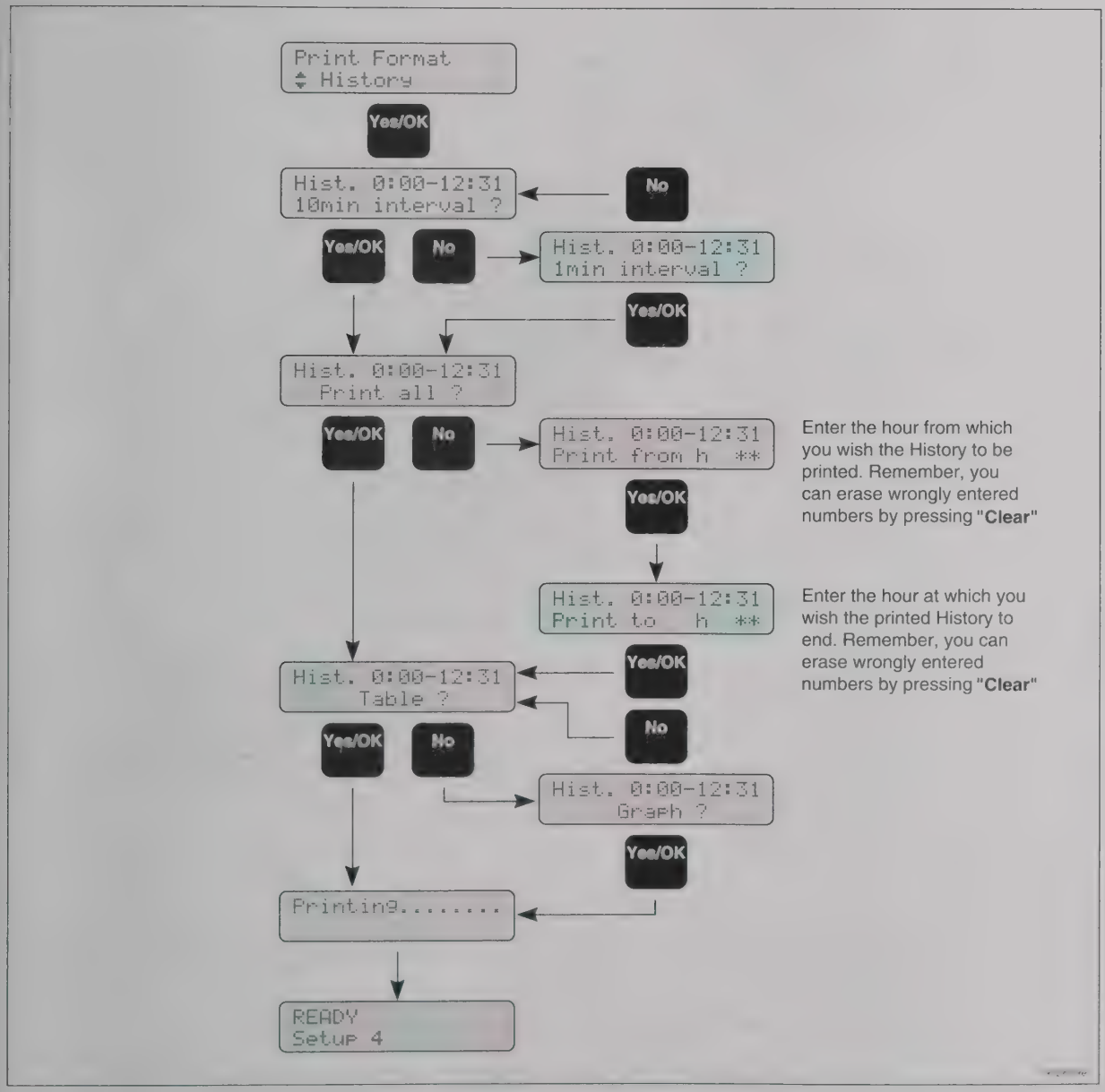

Fig. 8.7. Printing the History

Choosing a measurement interval 1 minute or 10 minutes

When you have selected the **History** option, the display shows two times. If the Type 4436 is in the **READY** mode, these times indicate when the last measurement was started and finished. If the Type 4436 is in the **RUN** or **PAUSE** mode, the times show when the current measurement was started and when you paused the measurement (the measurement need not be completed).

The display also asks you if you want the printed history to be presented as a series of 10-minute intervals.

1. If you want this press **"Yes/OK"**.

2. If, however, you want to present the history as a series of 1-minute periods, you should press **"No"**.

   The display then asks you if you want 1-minute intervals.

3. You do (there are only two options), so press **"Yes/OK"**.

Printing all or just part of a measurement period

Having selected the measurement interval, the display asks if you want to print all of the measurement period.

1. If you do, press **"Yes/OK"**.

2. If, however, you only want to print part of the measurement period, press **"No"**.

   The display then asks you to enter the start time of your printed History. (the 24-hour clock is used in the Type 4436).

3. Key in the hour (for example, if you entered **14**, your print-out would record measurements which started from 2 o'clock in the afternoon).

4. Press **"Yes/OK"**.

   The display then asks you to enter the stop time of your printed History. Key in the hour (for example, if you entered **18**, your print-out would record measurements which lasted up to **6** o'clock in the evening).

5. Press **"Yes/OK"**.

Choosing a table or graph

Having selected the period you want printed, the display asks if you want the print-out to be in the form of a table. See Fig. 8.8.

1. If you want the print-out to be in the form of a table, press **"Yes/OK"**.

2. If, however, you want your print-out to be in the form of a graph, press **"No"**.

   The display then asks you if you want the print-out to be in the form of a graph. See Fig. 8.9.

3. You do, so press **"Yes/OK"**.

The display indicates that printing is in progress. When the Type 4436 has transferred all its data to the printer, its display returns to either **READY**, **RUN** or **PAUSE**.

Note: If you look at Fig. 8.8, you can see that pauses are indicated in the print-out (for example, at **13:30**). But note that the next indication of L_{eq}, MaxL and MaxP (at **13:32**, when measurements were continued) refers to the 10-minute period (that is, from 13:30 to 13:40). Also, several continuous "Pause" lines might appear in the History print-out if there has been more than one pause during a 1-minute interval.

BRÜEL & KJÆR
Dose Meter Type 4436

Date D-M 25-01
Clock h:m 13:53
ID number 1
Remarks _____

h:m	Leq	MAXL	MAXP
12:28	Pause		
12:29	120.6	114.9	150.4
12:30	92.8	119.5	152.0
12:40	74.5	91.7	119.6
12:50	73.7	81.2	106.8
13:00	74.3	87.4	112.0
13:10	78.2	97.2	114.5
13:20	76.5	89.4	104.9
13:30	Pause		
13:32	78.1	55.8	80.5
13:40	55.2	79.9	111.0
13:47	Pause		
13:48	89.3	93.5	114.7
13:49	Pause		

Fig. 8.8. An example History print-out (table, 10-minute intervals)

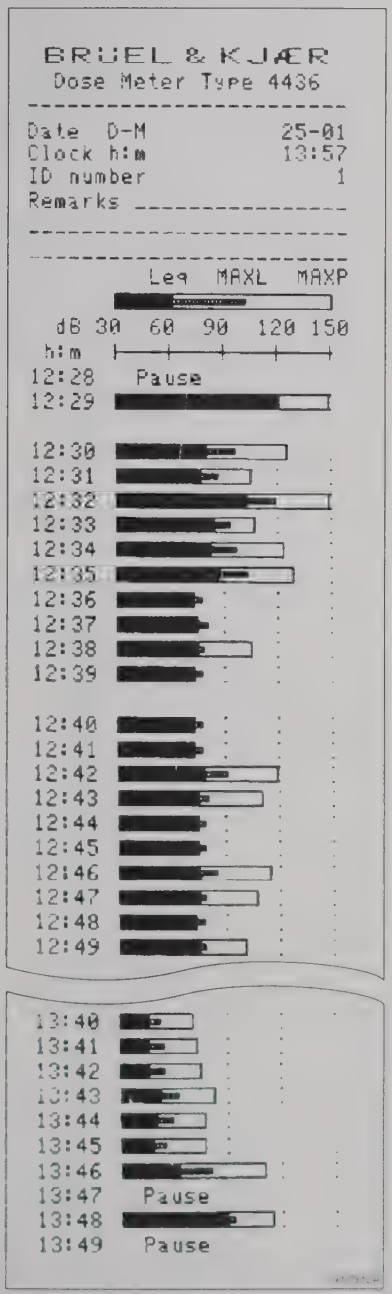

Fig. 8.9. An example History print-out (graph, 1-minute intervals)

8.2.3. Printing Statistics (See Fig. 8.10)

Statistics print-outs give information about either the Distribution or Cumulative Distribution of sound levels (see section 7.3). Print-outs can be in the form of either tables or graphs, and can be at 1 dB or 5 dB level intervals. Figs. 8.10 to 8.13 show examples of **Statistics** print-outs made with the Type 4436 and the Type 2318 Graphics Printer.

Choosing the Statistics Option

1. Press **"Print"**. The display indicates that it is in the **Print** function.
2. Use ▼ or ▲ to scroll through the options until you obtain the **Statistics** option.
3. Press **"Yes/OK"**.

Choosing the Distribution or Cumulative Distribution

When you have selected the **Statistics** option, the display asks if you want the **Distribution** to be printed.

1. If you do, press **"Yes/OK"**.
2. If, however, you do not want the **Distribution** to be printed, press **"No"**.

   The display then asks if you want the **Cumulative Distribution** to be printed.
3. You do (there are only two options), so press **"Yes/OK"**.

Choosing a level interval of 1dB or 5dB

When you have chosen between the **Distribution** and **Cumulative Distribution**, the display asks if you want the level interval to be 5 dB. This means that you can print the **Distribution** at, for example, 70 dB, then 75 dB, then 80 dB, and so on, at 5 dB intervals.

1. If you want the **Level Interval** to be 5 dB, press **"Yes/OK"**.
2. If, however, you want the **Level Interval** to be 1 dB, press **"No"**.

   The display then asks if you want the Level Interval to be 1 dB.
3. You do (there are only two Level Interval values), so press **"Yes/OK"**.

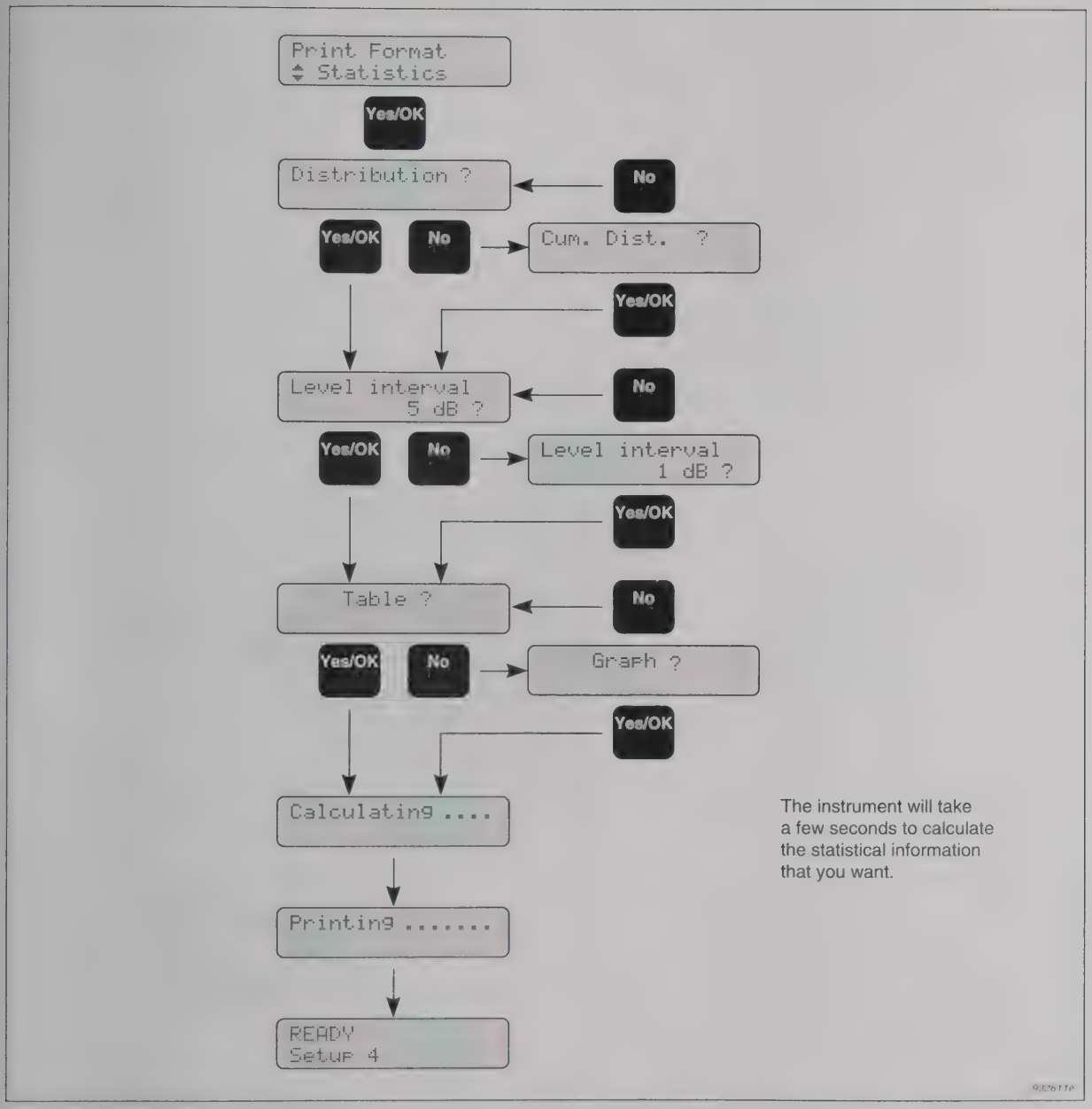

Fig. 8.10. Printing Statistics

Choosing a table or graph

When you have chosen the Level Interval, the display asks if you want the print-out to be in the form of a table.

1. If you want the print-out to be in the form of a table, press **"Yes/OK"**.

   Fig. 8.11 shows a tabular print-out of the **Distribution**, at 5 dB intervals. Fig. 8.12 shows a tabular print-out of the **Cumulative Distribution**, at 1 dB intervals.

2. If, however, you do not want the print-out to be in the form of a table, press **"No"**.

BRÜEL & KJÆR
Dose Meter Type 4436

Date D-M 25-01
Clock h:m 13:59
ID number 1
Remarks _____

Distribution

dB	%
40	6.6
45	8.2
50	3.6
55	0.8
60	0.2
65	0.5
70	49.2
75	21.2
80	5.0
85	2.3
90	1.6
95	0.3
100	0.2
105	0.0
110	0.0
115	0.0
120	0.0
125	0.0
130	0.0
135	0.0
140	0.0
145	0.0

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Fig. 8.11. An example Distribution print-out (table, 5 dB level intervals)

BRÜEL & KJÆR
Dose Meter Type 4436

Date D-M 25-01
Clock h:m 14:02
ID number 1
Remarks _____

Cum. Dist.

dB	%
41	100.0
42	99.5
43	97.5
44	95.6
45	93.4
46	91.1
47	88.9
48	87.6
49	86.1
50	85.2
51	84.3
52	83.1
53	82.4
54	82.0
75	30.9
76	23.9
77	18.9
78	15.1
79	12.3
80	9.7
81	8.2
82	7.4
83	6.2
84	5.5
85	4.7
86	4.2
87	3.9
88	3.0
89	2.7
90	2.4
91	2.2
92	2.0

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Fig. 8.12. An example Cumulative Distribution print-out (table, 1 dB level intervals)

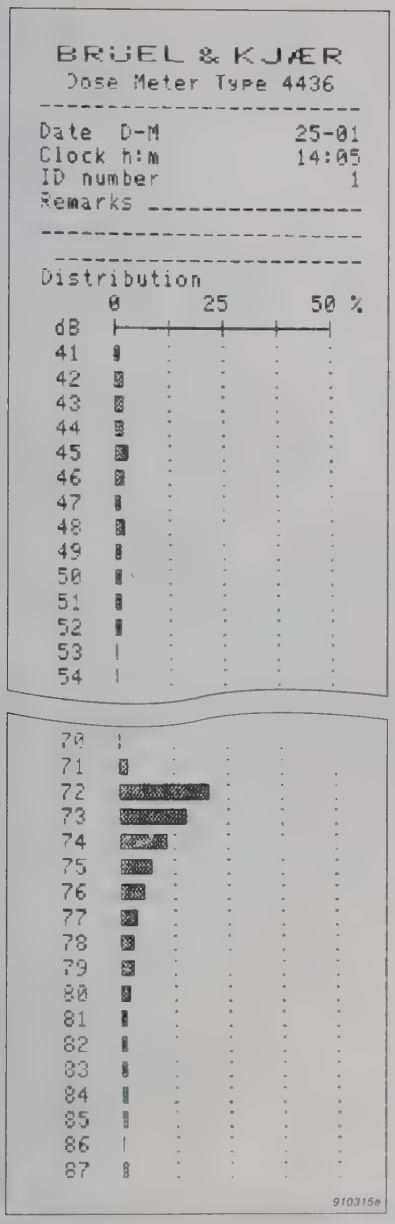


Fig. 8.13. An example Distribution print-out (graph, 1 dB level intervals)

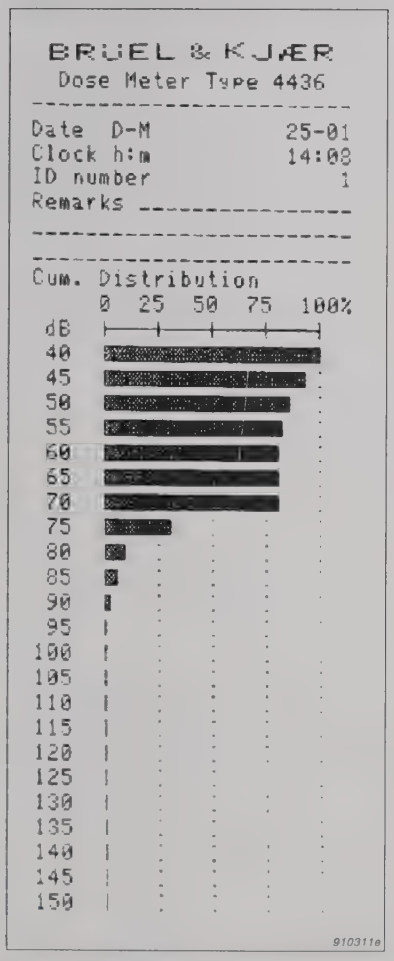


Fig. 8.14. An example Cumulative Distribution print-out (graph, 5 dB level intervals)

The display then asks if you want the print-out to be in the form of a table.

3. You do (you have only two options), so press **"Yes/OK"**.

Fig. 8.13 shows a graphical print-out of the **Distribution**, at 1 dB intervals. Fig. 8.14 shows a graphical print-out of the **Cumulative Distribution**, at 5 dB intervals.

Once you have chosen either the **Table** or **Graph** option, the display indicates that it is calculating the statistical information that you asked for. This takes a couple of seconds. Then the display indicates that printing is in progress.

When the Type 4436 has transferred its data to the printer, its display returns to either **READY**, **RUN** or **PAUSE**.

8.3. MARKING PRINT-OUTS WITH AN IDENTIFICATION (ID) NUMBER

The **ID** function can be used in either the **READY**, **RUN** or **PAUSE** mode.

When you produce print-outs of measurement data with the Type 4436 and a suitable printer, these print-outs are automatically marked with an ID number. You can define this ID number. Thus you can keep a series of measurements in good order. For example, if you have a number of workers wearing Type 4436 Noise Dose Meters, you can allocate a particular ID Number to each instrument or worker.

You can select an ID number before or after you have made a measurement, though of course you should do it before you actually make a print-out of those measurement results.

1. Press **"ID"**.

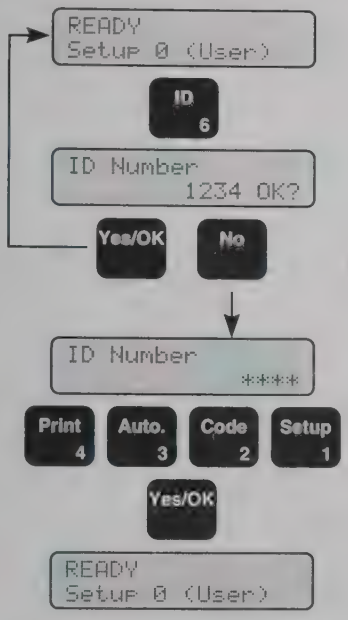
   The second display shown in Fig. 8.15 appears. It presents you with an ID number, and asks you if that number is OK for your current set of measurements. You can respond in one of two ways.

2. You can either approve of the ID number presented to you – by pressing **"Yes/OK"**.

3. Or you can choose to key in another ID number, by pressing **"No"**.

   When you press **"No"**, the display invites you to key in in a new ID number for your measurements. The number can be anything from **0** to **9999**, and you have to key in four digits – for example, if you want the **ID** number to be **"8"**, you have to enter **0008**. Remember, you can erase wrongly entered numbers by pressing **"Clear"**.

4. When you have keyed in the **ID** number, enter it by pressing **"Yes/OK"**.



The display shows you an ID number. If this number is okay, press Yes/OK. Otherwise, press No

Enter a new ID number. The range of ID number is 0-9999. Remember, you can erase wrongly entered numbers by pressing Clear

You have entered the ID number 4321, and this will accompany all printouts of this particular measurement data.

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Fig. 8.15. Entering an ID Number

9. USING THE TYPE 4436 WITH A COMPUTER

In this chapter, we shall show you how to use the Type 4436 with a computer. First of all, we shall deal with the more general information of how you set up the Type 4436 with a computer, and describe the application software you can use. Each of the Type 4436's output options is used with particular application software, so we shall then show you how to use these options to transfer data to a computer. For more detailed information about what happens during such data transfer, see section 12.2.

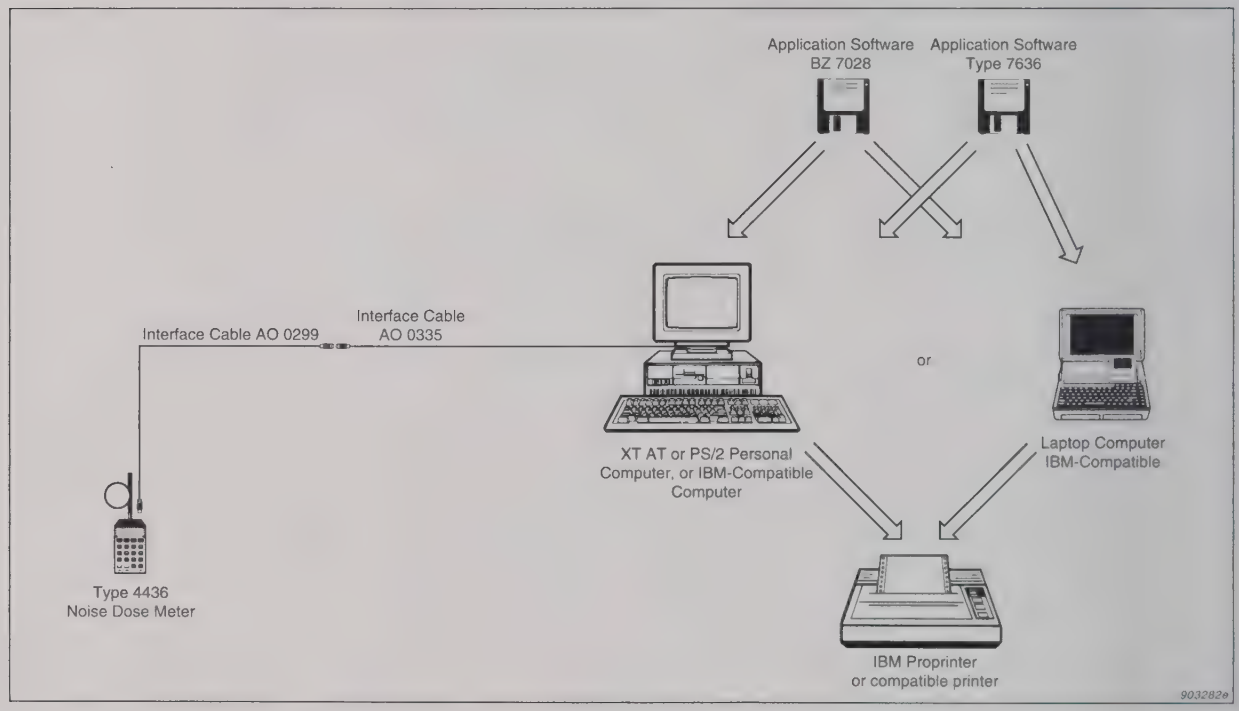

Fig. 9.1. Connecting the Noise Dose Meter and a computer

9.1. TYPES OF COMPUTER

The Type 4436 can be used with the following types of computer. They should be using DOS Version 3.0 or later.

- **Olivetti M211 Laptop Computer (or similar)**
- **IBM XT, AT or PS/2 Personal Computer**
- **Other IBM-compatible Personal Computers may be used, but absolute compatibility cannot be guaranteed**

Note: The BZ 7028 Application Software (see section 9.6), can be used only on a PS/2 personal computer or an Olivetti laptop computer.

9.2. CONNECTING THE TYPE 4436 TO A COMPUTER

Before connecting the Type 4436 to a computer, both instruments MUST be switched ON or both instruments should be switched OFF. When you are finished using the Type 4436 with a computer, switch the computer OFF (or disconnect it from the Type 4436) *before* switching the Type 4436 off.

You need two cables to connect the Type 4436 to a computer (Interface Cables AO 0299 and AO 0335). Fig. 9.1 shows these cables, and how they should be connected. Fig. 3.3 shows the Type 4436's Digital Output socket.

9.3. WHAT APPLICATION SOFTWARE DO YOU WANT TO USE?

The application software given below can be used with the output options of the Type 4436. The following sections give information on how to use each software with the appropriate output option.

- **BK–LINK Software Version 2.0 (or some other suitable communications software, like ProComm)**
- **Software Type 7636 for Statistical Noise Level Analysis**
- **Application Software BZ7028 for Use with Type 4436 Noise Dose Meter**

9.4. USING THE BK-LINK SOFTWARE VERSION 2.0

BK-LINK is software which has been especially developed to receive data from Brüel & Kjær instruments and present it in tabulated form. **BK-LINK** is free, and available from your local Brüel & Kjær representative.

BK-LINK is used with either the **PC Transfer** option or with the **Print** option which are normally used with a printer (see section 8.2). In both cases, the **Status**, **History** and **Statistics** are transferred to computer. But the following differences should be considered when you are deciding between the **PC Transfer** and **Print** options:

PC Transfer: **Status**, **Statistics** and **History** data are read out in a block. Only **Distribution** data is transferred as part of the **Statistics**. All level classes in the **Distribution** are listed (23 dB to 149 dB) even if they occur outside the lowest and highest recorded levels.

Print option: Allows separate read out of **Status**, **History** and **Statistics** data. Both **Distribution** and **Cumulative Distribution** data are output when **Statistics** is chosen. Also, only those levels which occur between the lowest and highest recorded levels are listed with **Distribution** and **Cumulative Distribution**.

9.4.1 Configuring the BK-LINK Software

If the Type 4436 and the BK-LINK software are to communicate properly, they must be properly configured. Below, we give the correct configuration for BK-LINK.

- Com 1
- Baud Rate of 9600
- 8 Databits
- 1 Stopbit
- No Parity
- Forcing Bit 7 – None
- Handshake – Xon/Xoff

Note: With **PC Transfer** the Type 4436's Baud Rate is automatically set to 9600 during transmission. After transmission, the Baud Rate is automatically reset to what it was before.

9.4.2. Using the PC Transfer Option

You can use **PC Transfer** when the Type 4436 is in the **READY**, **RUN** or **PAUSE** mode.

When you use the **PC Transfer**, the Type 4436 sends all tabulated data (the **Status**, **Statistics** and **History**) to a computer. **BK-LINK** then processes this data, and presents it in readable form.

When you use **PC Transfer**, the Type 4436 sends all data (the **Status**, **Statistics** and **History**) to a computer. **BK-LINK** then processes this data, and lists it in tabular form.

Before you go on, make sure that the Type 4436 is properly connected to the personal computer.

1. Press the **"Print"** pushkey on the Type 4436. See Fig. 9.2.

2. Use the ▼ or ▲ pushkeys to obtain the display which indicates the **PC Transfer** option.

3. Press **"Yes/OK"**.

   The display indicates that the Type 4436 is waiting for an "answer" from the Personal Computer. At this point, you can exit the procedure by pressing **"Yes/OK"** again. This is useful if you discover that you have chosen the wrong output option or have configured **BK-LINK** wrongly.

4. Press the <**Enter**> key on the computer keyboard, and keep pressing it until the computer screen shows a **"$"** symbol.

   The Type 4436 then starts transferring its **Status**, **Statistics** and **History** data to the Personal Computer. The display of the Type 4436 indicates which type of data is currently being transferred, and the computer screen correspondingly displays the data contained in these output options. When the data transfer is finished, the display returns to either **READY**, **RUN** or **PAUSE**.

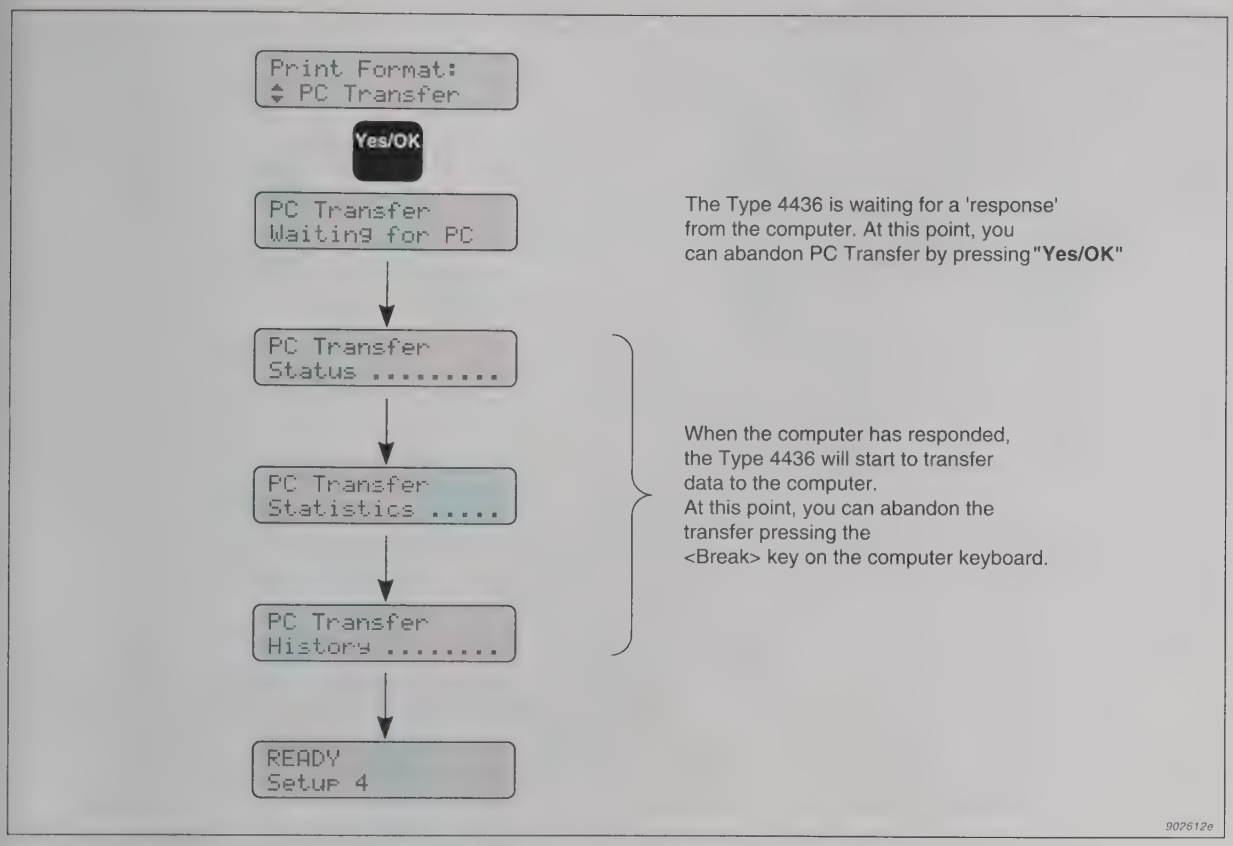
Print Format:
PC Transfer
Yes/OK
PC Transfer
Waiting for PC
PC Transfer
Status .....
PC Transfer
Statistics .....
PC Transfer
History .....
READY
Setup 4
The Type 4436 is waiting for a 'response' from the computer. At this point, you can abandon PC Transfer by pressing "Yes/OK"
When the computer has responded, the Type 4436 will start to transfer data to the computer. At this point, you can abandon the transfer pressing the <Break> key on the computer keyboard.
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Fig. 9.2. Using the PC Transfer option

9.4.3. Using the Print Status, Print History or Print Statistics Options with a Computer

You can use these options when the Type 4436 is in either the **READY**, **RUN** or **PAUSE** mode. Before you go on, make sure that the Type 4436 is properly connected to the personal computer.

1. Press the **"Print"** pushkey. See Fig. 9.3.

2. Use the ▼ or ▲ pushkeys to obtain the display which indicates the particular **Print** option that you want (**Status**, **History** or **Statistics**).

3. Press **"Yes/OK"**.

   The Type 4436 then starts transferring its data to the Personal Computer, and its display indicates that it is "Printing". Either the **Status**, **History** or **Statistics** appears on the computer screen. When the data transfer is finished, the display returns to either **READY, RUN** or **PAUSE**.

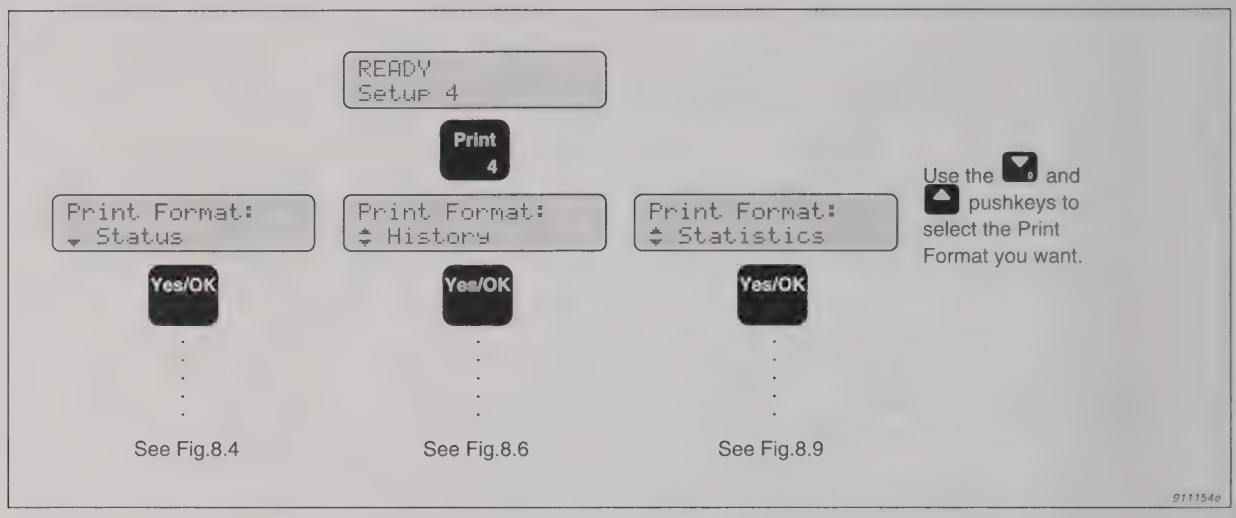


Fig. 9.3. Using the Print Status, History or Statistics options

9.5. APPLICATION SOFTWARE TYPE 7636

Application Software Type 7636 for Statistical Noise Level Analysis receives 1-second L_{eq} (or L_{av}), MaxL and MaxP values from the Type 4436. Using this data, Type 7636 forms two databases, one containing noise events and the other containing hourly statistical reports, which can be viewed later on screen. Type 7636 also gives you access to

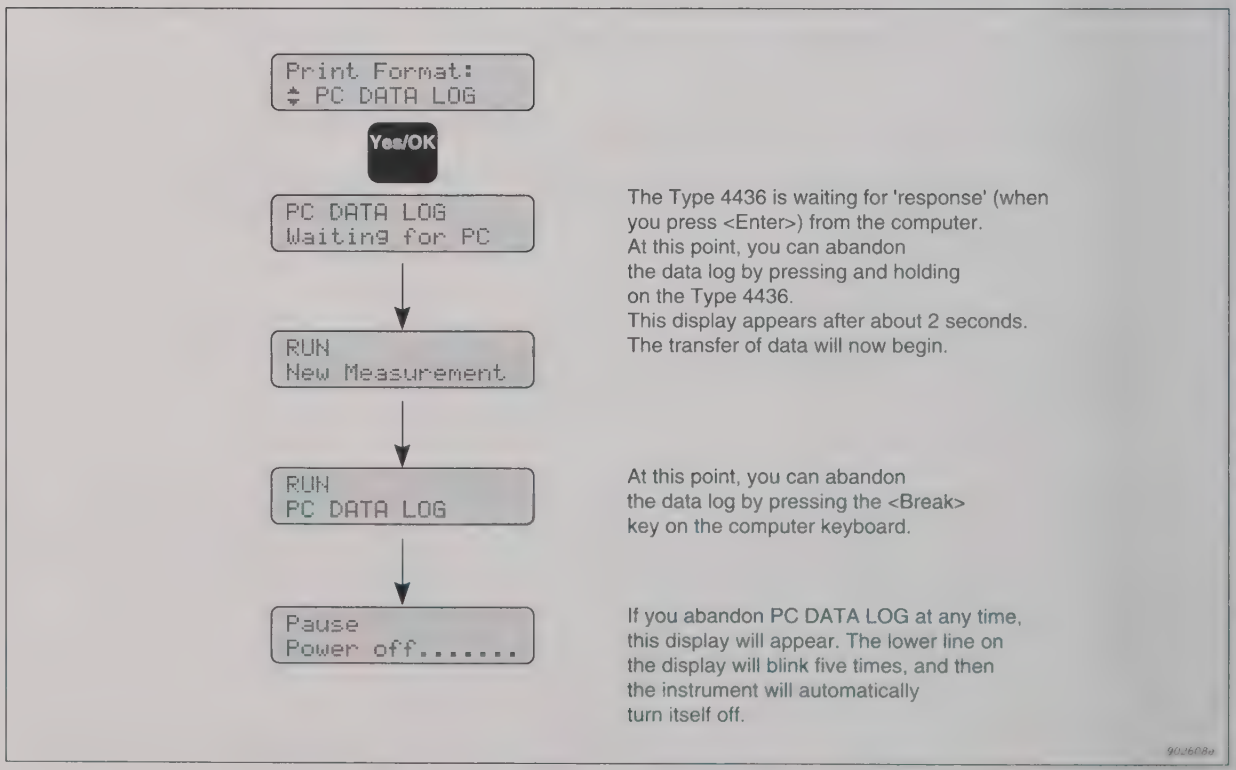

Print Format:
PC DATA LOG
Yes/OK
PC DATA LOG
Waiting for PC
RUN
New Measurement
RUN
PC DATA LOG
Pause
Power off.....
The Type 4436 is waiting for 'response' (when you press <Enter>) from the computer. At this point, you can abandon the data log by pressing and holding on the Type 4436. This display appears after about 2 seconds. The transfer of data will now begin.
At this point, you can abandon the data log by pressing the <Break> key on the computer keyboard.
If you abandon PC DATA LOG at any time, this display will appear. The lower line on the display will blink five times, and then the instrument will automatically turn itself off.

Fig. 9.4. Using the PC DATA LOG option

noise Monitoring System Type 7618 and other software packages – spreadsheets, for example. Type 7636 is used with the **PC DATA LOG** option of the Type 4436, which is obtained in the **Print** function.

To find out how to use the Type 4436 with Type 7636 Application Software, refer to the Type 7636 Instruction Manual. Fig. 9.3 shows the display and pushkey sequences for the the **PC DATA LOG** option.

9.6. APPLICATION SOFTWARE BZ7028

Application Software BZ 7028 receives all measurement data from the Type 4436. BZ 7028 offers you Noise Distribution graphs, Status reports and History strip graphs. It lets you edit, print or export data and can be used to combine files (e.g. combine daily measurement data to see what the weekly exposure was). BZ 7029 is used with the **PC Dump** option of the Type 4436, which is obtained in the **Print** function.

To find out how to use the Type 4436 with BZ 7028, refer to the Instruction Manual for the BZ 7028. Fig. 9.5 shows the display and pushkey sequences for the **PC Dump** option. Note the following points:

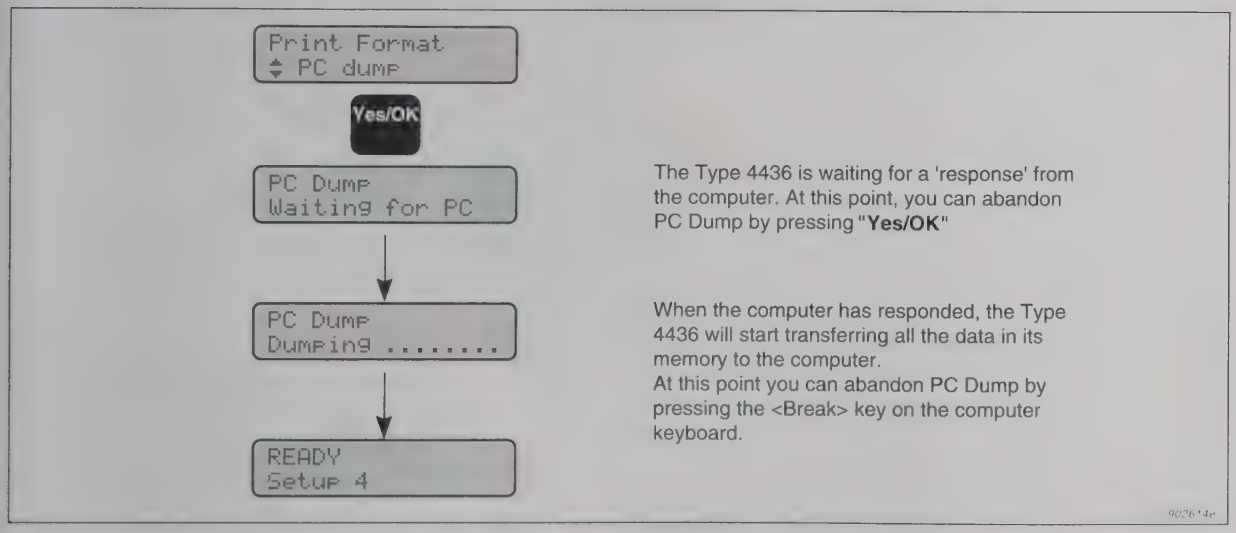

Print Format
PC dump
Yes/OK
PC Dump
Waiting for PC
PC Dump
Dumping .....
READY
Setup 4
The Type 4436 is waiting for a 'response' from the computer. At this point, you can abandon PC Dump by pressing "Yes/OK"
When the computer has responded, the Type 4436 will start transferring all the data in its memory to the computer.
At this point you can abandon PC Dump by pressing the <Break> key on the computer keyboard.

Fig. 9.5. Using the PC Dump option

10. CARE AND SERVICE OF THE TYPE 4436

The Type 4436 is a strong, resilient instrument, which with proper care and attention as outlined in section 10.1 will provide you with many years of reliable operation. However, if at any time you suspect that the instrument is not working correctly, the performance checks in section 10.2 should be made. For repair please contact your local Brüel & Kjær service representative. Under no circumstance should repair be attempted by persons not specially trained in the service of Bruel & Kjær equipment.

10.1. TAKING CARE OF THE TYPE 4436

10.1.1. A Few Simple Guidelines

- Before connecting the Type 4436 to other digital devices (a printer or computer), make sure that all instruments are switched on or that they are all switched off.
- When you are finished using the Type 4436 with a computer, switch the computer off (or disconnect it from the Type 4436) *before* switching the Type 4436 off.
- Attach all cables gently, making sure that you are inserting them correctly.
- Do not expose the instrument to unnecessary impact and vibration – these might affect measurement accuracy.
- Regularly check the dust filter at the end of the rubber tube which guides sounds to the internal microphone. If you see that the filter is clogged, replace it as shown in section 10.1.2.
- Do not shorten the rubber tube which guides sounds to the microphone, and use only the supplied spare tube for replacement, as shown in section 10.1.3.
- When they are not being used, keep the Ext. Preamp. and Digital Output sockets fitted with their dustcaps. See section 10.1.2.
- Try not to leave the instrument too long in strong sunlight or hot environments, as it can affect the appearance of the instrument.
- When cleaning the instrument, use only a cloth which has been moistened with water. Do not use solvents.
- If you do not intend to use the Noise Dose Meter for one month or more, remove the battery, and store the instrument in its case.

10.1.2. Dustcaps and Filters

The Ext. Preamp. and Digital Output sockets at the top of the instrument are protected by dustcaps. Four spare dustcaps are supplied with the instrument. Whenever you are not using these sockets, protect them with a dustcap.

Four metal gauze filters are supplied with the Type 4436. A filter fits into the rigid casing at the top of the rubber tube, stopping dirt and dust from getting into the tube. To replace a filter, just screw off the rigid casing at the top of the rubber tube, remove the old filter, insert a new filter, and screw the casing back onto the top of the tube.

10.1.3. Replacing the Rubber Tube

The rubber tube guides sound signals down to the internal microphone. The tube's diameter is approximately 1/4-inch (6.35 mm). With proper care, it will last for years. But should the tube need replacing, a spare tube AF 0119 is supplied. Fig. 10.1 shows you how to replace the rubber tube.

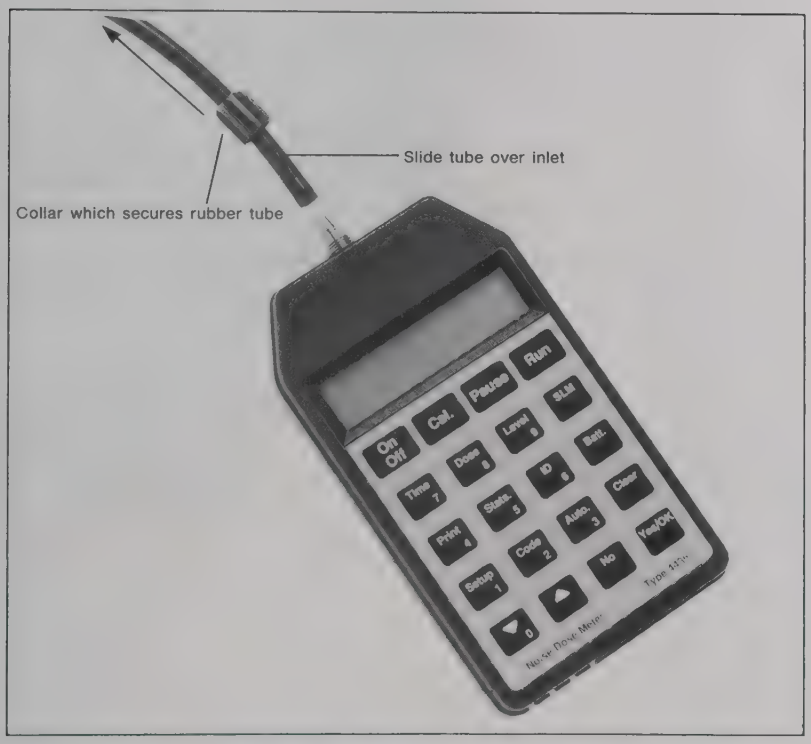


Fig. 10.1. Replacing a rubber tube

1. Unscrew the notched brass collar which secures the rubber tube to the Type 4436.

2. Pull the rubber tube from the microphone inlet at the top of the Type 4436 (this might require a little strength, but should be done carefully all the same).

3. Remove the brass collar from the old tube.

4. Slide the new rubber tube through the brass collar.

5. Pull the rubber tube over the microphone inlet at the top of the Type 4436. Make sure that the rubber tube is secure by tugging it gently.

6. Re-screw the brass collar to the Type 4436, thus securing the rubber tube to the Type 4436.

10.2. PERFORMING SELF TESTS

With the **Self Test** options, you can check that the following are working correctly:

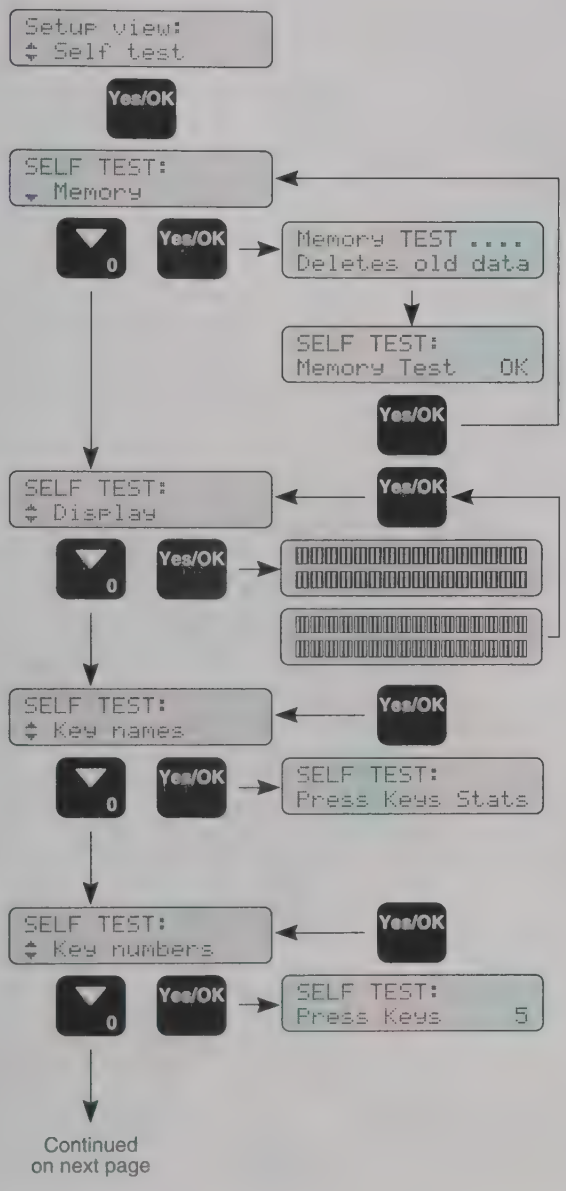
- **The Type 4436's memory**
- **The Type 4436's display**
- **The Type 4436's pushkeys**
- **The serial interface**

If, when checking these facilities, you find that they are not OK, you should consult your local Brüel & Kjær service representative, saying what the error is and stating any error code, if applicable.

If, when checking these facilities, you find that they are not functioning correctly you should inform your local Brüel & Kjær service representative, saying what the error is and stating any error code, if applicable.

We shall now describe how to perform the self tests. Each test is described in turn, but you can in fact use them in any order. Figs. 10.2 (a) and (b) show the display and push-key sequence for the Self Tests.

Note: Some of the serial interface tests require that you use either a printer or a computer. To see how to connect the Type 4436 to a printer or computer, see sections 8.1.2 and 9.2 respectively. When using the Serial Interface Test with a computer, you should use Brüel & Kjær's own communications software (BK-LINK Version 2.0) or similar (e.g. ProComm).



The instrument's program and memory are tested. This takes about 5 seconds.
This is a "destructive" test, and you should recalibrate the Type 4436 before making any new measurements.

Error in ROM RAM
code 124 253

This appears if the Memory Test is not okay

The display is tested.
Press "**Yes/OK**" to stop the test.

The pushkeys are tested.
When you press a pushkey the text or symbol on that pushkey should appear on the display.
The example shows "**Stats.**"

The pushkeys are tested. Each pushkey has a number allocated to it. On Off is '1'. "**Time**" is '2'. This goes on until "**Clear**" which is '19'.
To stop this test, press "**Yes/OK**"

The example shows what appears on the display when you press 0. That is, the number '5' appears on the display.

Fig. 10.2 (a). Selecting the Self Test Options

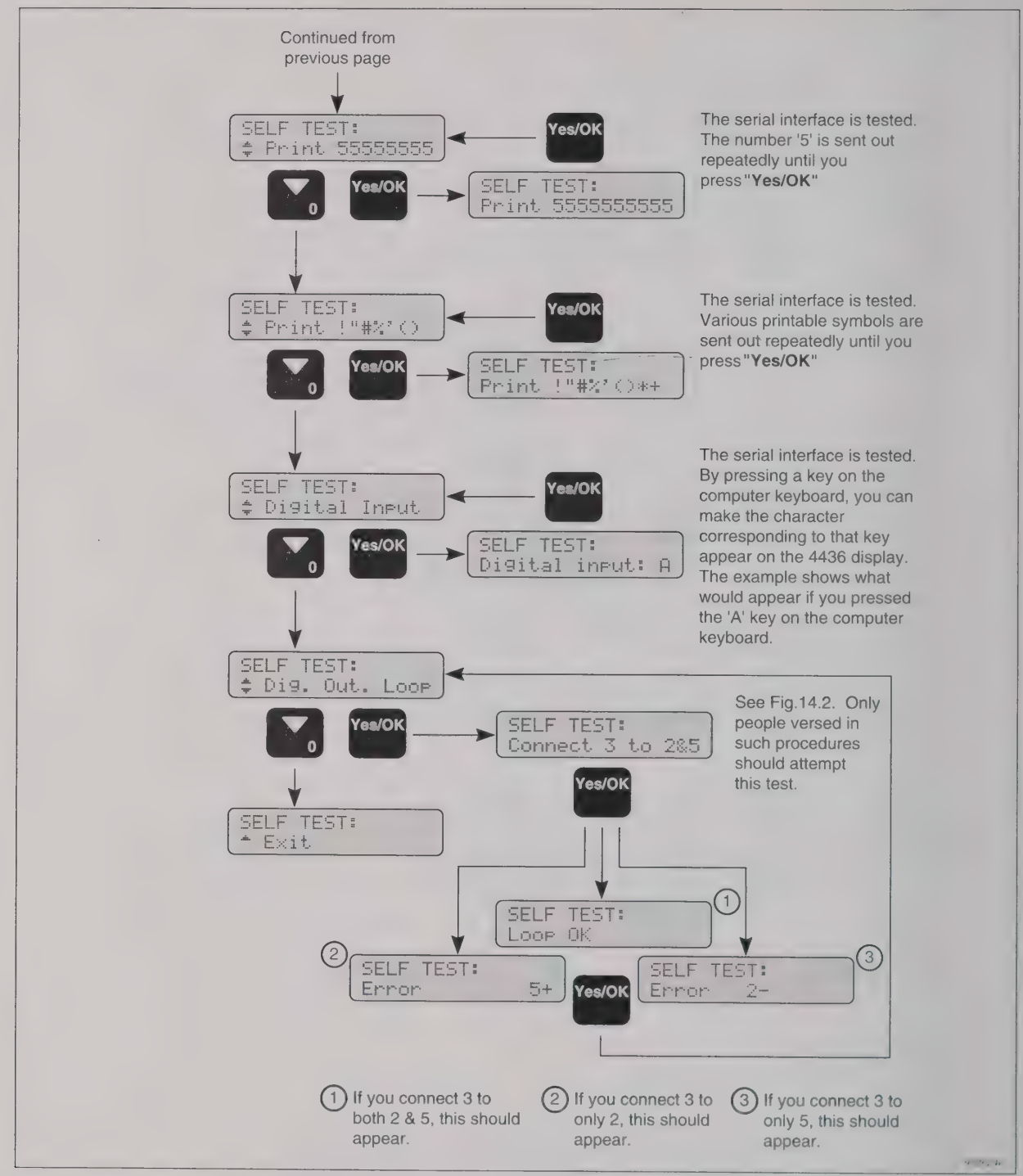

Continued from previous page
SELF TEST:
≑ Print 55555555
Yes/OK
0
Yes/OK
SELF TEST:
Print 5555555555
The serial interface is tested. The number '5' is sent out repeatedly until you press "Yes/OK"
SELF TEST:
≑ Print !"#%'()
Yes/OK
0
Yes/OK
SELF TEST:
Print !"#%'()*+
The serial interface is tested. Various printable symbols are sent out repeatedly until you press "Yes/OK"
SELF TEST:
≑ Digital Input
Yes/OK
0
Yes/OK
SELF TEST:
Digital input: A
The serial interface is tested. By pressing a key on the computer keyboard, you can make the character corresponding to that key appear on the 4436 display. The example shows what would appear if you pressed the 'A' key on the computer keyboard.
SELF TEST:
≑ Dig. Out. Loop
0
Yes/OK
SELF TEST:
Connect 3 to 2&5
See Fig.14.2. Only people versed in such procedures should attempt this test.
Yes/OK
SELF TEST:
▲ Exit
SELF TEST:
Loop OK
1
2
SELF TEST:
Error 5+
Yes/OK
SELF TEST:
Error 2-
3
1 If you connect 3 to both 2 & 5, this should appear.
2 If you connect 3 to only 2, this should appear.
3 If you connect 3 to only 5, this should appear.

Fig. 10.2 (b). Selecting the Self Test Options

Selecting a Self Test Option

You can use the **Self Test** options only in the **READY** mode. The procedure for obtaining and selecting a particular **Self Test** option is as follows:

1. Press **"Setup"**. See Fig. 10.2 (a).

2. Use the ▼ or ▲ to obtain the display which tells you that you are in the **Self Test** setup. Press **"Yes/OK"**.

3. Use ▼ or ▲ to scroll through the options until the display shows the one that you want.

4. Press **"Yes/OK"**.

5. Perform the particular test.

6. Press **"Yes/OK"** when you are finished with a test.

   Note: To exit the **Self Test** function, press ▼ until **Exit** is displayed. Then press **"Yes/OK"** to return to the **READY** display.

We shall now describe each of the **Self Test** options in turn.

Memory Test

Before you do a Memory Test, make sure that you have either recorded the measurement data in some way, or have no need for the data, and do not mind its being deleted.

During a **Memory Test**, the display indicates that it is performing as much. It also indicates that old measurement data will be deleted in the process. When the memory test is finished, the display indicates either that the memory is OK or that an error in the Type 4436's ROM and/or RAM has been located, in which case the display shows an error code. If this happens, consult your local Brüel & Kjær service engineer, stating the error code.

Display Test

When you test the display, the five vertical lines in each character space's 5 × 8 matrix starts switching on and off. First, three of these lines switch on. Then the other two switch on. They will continue to alternate thus. See Fig. 10.2 (a).

Key Test (Names)

In this test, the logo on the pushkey that you press appears on the display (except for the **"Yes/OK"** pushkey, which returns you to the **Key names** display).

Key Test (Numbers)

In this test, a number is allocated to each pushkey. When you a press a pushkey, the number allocated to it appears on the display (except for the **"Yes/OK"** pushkey, which returns you to the **Key numbers** display).

As Fig. 10.2 (a) indicates, **"On/Off"** is allocated the number **1**, **"Time"** is given the number **2**, and so on. This goes on until **"Clear"**, which is given the number **19**. Fig. 10.2 (a) shows what appears when you press **"Stats."**.

Serial Interface Tests

There are four serial interface tests, which check the Type 4436's ability to communicate with other digital devices (a printer or computer). We shall now describe these tests. Please note that the first two tests, being similar, are described together. See Fig. 10.2 (b) for the displays which appear in these procedures.

Print 55555555 and **Print !"#$%&'()*+**

To perform these tests, the Type 4436 should be connected to a printer or computer (see sections 8.1.2 and 9.2 respectively). When using these tests with a computer, you should use BK-LINK Version 2.0 application software or similar (see section 9.4).

During these tests, the Type 4436's display indicates that it is transmitting a series of the number **5** or other printable symbols (e.g. **!"#$%&'()*+**). The output is printed or appears on the computer screen.

Digital Input

To perform this test, the Type 4436 should be connected to a computer (see section 9.2). You should use BK-LINK Version 2.0 application software or similar (see section 9.4).

In this test, when you press a particular key on the computer keyboard, the display on the Type 4436 responds by showing the character which corresponds to that key.

Digital Output Loop (Dig. Out. Loop)

This test checks that the Digital Output socket is working correctly. The test should be performed only by Brüel & Kjær service personnel – otherwise, damage might result.

Exit

To exit the **Self Test** function, press ▼ until **Exit** is displayed. Then press **"Yes/OK"** to return to the **READY** display.

11. STANDARDS, DIRECTIVES AND TERMINOLOGY

In this chapter, we shall mention the standards and directives which apply to noise dosimetry, and describe some of the parameters they recommend. A glossary of terms is also included in this chapter.

11.1. COMPLIANCE WITH STANDARDS AND DIRECTIVES

The Type 4436 Noise Dose Meter complies, where relevant, with the following standards and directives, which make various recommendations about the measurement of noise and the calculation of noise dose levels.

EEC Directive EEC/86/188 – The protection of workers from the risks related to the exposure to noise at work.

IEC Draft 29c (Central Office) 43 – Personal Sound Exposure Meters.

BS6402:1983 – Personal Sound Exposure Meters.

ANSIS1.25–198X Draft 1986, April – Personal Noise Dosimeter.

IEC Publ.651 – Sound Level Meters

IEC PUBL. 804 1985 – Integrating-Averaging SLM Type 2.

ANSIS1.43–198X 13th Draft 1986, Nov.17 – Integrating-Averaging SLM Type 2.

11.2. GLOSSARY OF TERMS

Cumulative Distribution: The percentage of all sound levels (see SPL) occurring at or above a certain dB level. For example, if the cumulative distribution is 76 % at 90 dB, this means that 76 % of all measured sound levels were either 90 dB or above.

Distribution: The percentage of all sound levels (see SPL) occurring over a certain dB range. For example, if the distribution is 14 % at 90 dB, this means that 14 % of all measured sound levels were 90 dB to 90.9 dB (if you have chosen a Level Interval of 1 dB – see **Level Interval** below).

Dose %: The amount of sound received by a worker, expressed as a percentage of the daily allowed dose. The **Setup** function lets you select a daily allowed 100 % Dose corresponding to either 80, 84, 85 or 90 dB (A) for 8 hours. The display range for the **Dose %** is 0 % to 9999 %.

Exchange rate (q):

If the maximum allowed L_{eq} (or L_{av}) for 8 hours (one working day) or 40 hours (one working week), is exceeded and cannot be reduced, the amount of time that workers are exposed to such noise should be cut.

The exchange rate (also known as the halving rate) is a means of gauging by how much the exposure time should be reduced. With an exchange rate of **3**, for example, the exposure time should be halved for every 3 dB that the measured L_{eq} exceeds the allowed L_{eq}. Thus, if the recommended L_{eq} was 90db (A) for 8-hour periods, as it is Denmark, and if it was found that the 8-hour L_{eq} (A) for a factory was 96 dB (90 dB + (2 × 3 dB)), then the amount of time that workers should be exposed to that level would be 2 hours per day (8 hours × 1/2 × 1/2).

The exchange rate in Denmark and many other countries is 3. But in some countries (like the USA and parts of Canada) it is 5. The Type 4436 caters for exchange rates of 3, 4 and 5.

Level Interval:

When you use the Distribution or Cumulative Distribution functions, you can decide the interval between the levels whose statistical characteristic you want to find out.

If you choose a level interval of 1 dB, calculations are based on sound levels taken in 1 dB steps and you can view the distribution or cumulative distribution in 1 dB steps. If you choose a level interval of 5 dB, calculations are based on sound levels taken in 5 dB steps, and you can view the distribution or cumulative distribution in 5 dB steps.

If you are viewing the distribution, and look at, say, the distribution of sound levels at 90 dB, then the % level refers to the range 90 dB to 90.9 dB (if you had a level interval of 1 dB) or 90 dB to 94.9 dB (if you had a level interval of 5 dB.

L_{av}:

L_{av} is the average sound level for the measurement period. If the exchange rate you have chosen is not 3, then instead of getting an L_{eq} value, you get L_{av}.

$L_{EP,d}$:

The Daily Personal Noise Exposure. A parameter recommended by **EEC Directive (EEC/86/188)**. It is derived from the L_{eq}, the daily duration of a worker's exposure to noise and the A-weighted sound pressure in Pascals to which a worker is exposed. In **IEC Draft 29c**, the $L_{EP,d}$ is referred to as L_{A8hn}. See section 11.3.

L_{eq}:

The Equivalent Continuous Sound Level. A much used parameter, corresponding to the mean energy of sound levels averaged over a measurement period – that is, it is the continuous steady noise level which would have the same acoustic energy as the actual, fluctuating noise levels measured over the same period of time.

MaxL:

The maximum Sound Pressure Level (SPL) in the current measurement period.

MaxP:

The maximum Peak level in the current measurement period.

Pa^2h:

The Sound Exposure, measured in the linear unit Pascal Squared Hours, which is a linear unit recommended in **IEC Draft 29c.** See section 11.3.

PC DATA LOG: One of the three output options for use with a Personal Computer. With PC DATA LOG, the Type 4436, during measurements, sends the L_{eq} (or L_{av}), the MaxL and the MaxP values to the computer every second. **PC DATA LOG** is used with Application Sfotware Type 7636.

PC Dump: One of the three output options for use with a Personal Computer. With PC Dump, the Type 4436 sends all its measurement data to a computer. Application Software BZ 7028, dedicated to the Type 4436, processes that data. BZ 7028 lets you view, edit and print the Type 4436's status and measurement data.

PC Transfer: One of the three output options for use with a Personal Computer. With PC transfer, the Type 4436 sends all non-graphic output (the Status, Statistics and History) to the computer. **PC Transfer** is used with suitable communications software (e.g. BK-LINK Version 2.0).

Peak: The maximum amplitude reached by a sound signal in the previous second.

PSEL: The Personal Sound Exposure Level. The constant sound level which, if lasting for eight hours, would deliver the same amount of acoustical energy as that delivered over the entire measurement period. In essence, the PSEL is the L_{eq} normalized to a duration of eight hours, and corresponds to the SEL minus 44.6 dB. See section 11.4.

SEL: The Sound Exposure Level. The constant sound level which, if lasting for one second, would deliver the same amount of acoustical energy as that delivered over the entire measurement period. In essence, the SEL is the L_{eq} normalized to a duration of one second.

SPL: The Sound Pressure Level. The sound pressure, referred to 20 μPa. The word "Level" indicates that the sound pressure has a certain level above the reference level. The SPL is displayed each second as the maximum value (Slow or Fast Time Weighting) for the previous 1-second period.

Statistics: See **Distribution** and **Cumulative Distribution.**

Status: One of the three print-out options. It gives detailed information about the instrument's set-up, the measurement duration, noise dose and sound levels.

Threshold value: Any sound levels below the threshold value do not contribute to L_{eq} (or L_{av}) and Dose measurement data. Thus, if you set the threshold value to 80, any sound levels below 80 dB are not taken into consideration by the instrument when it calculates the dose levels and noise levels. The threshold value "off", however, means that all measured sound levels contribute to results. Available threshold values "off", 75, 80, 85 and 90 dB

Time history: One of the three print-out options. It gives a history of your measurement results, with regards to the L_{eq}, MaxL and MaxP. This history can be shown at either 1-minute or 10-minute intervals.

8h Dose %: The Dose % extrapolated to a period of eight hours.

8h Sound Exposure Pa^2h: The Sound Exposure Pa^2 h extrapolated to a period of eight hours.

100% 8h level: The 8-hour L_{eq} (or L_{av}) sound level which, if exceeded, constitutes too high a noise exposure level. The Type 4436 gives you four options: 80, 84, 85 or 90 dB

11.3. THE $L_{EP,d}$ and Pa^2h PARAMETERS AND THEIR RELATIONSHIP

$L_{EP,d}$ (Daily Personal Noise Exposure)

$L_{EP,d}$ is a parameter recommended by **EEC Directive EEC/86/188** – "The protection of workers from the risks related to the exposure to noise at work." $L_{EP,d}$ is also referred to as L_{A8hn}, a parameter recommended by **IEC Draft 29c**.

The formula for calculating the $L_{EP,d}$ is as follows:

$$L_{EP,d} = L_{Aeq,Te} + 10 \log_{10} \frac{Te}{T0}$$

where,

$$L_{Aeq,T_e} = 10 \, Log_{10} \left\{ \frac{1}{T_e} \int_0^{T_e} \left[\frac{p_A(t)}{p_0} \right]^2 dt \right\}$$

and,

T_e = daily duration of workers' personal exposure to noise – a figure which you yourself set (see section 7.1, with reference to $L_{EP,d}$)
T_0 = 8 h = 28 800 seconds
p_0 = 20 μPa
p_A = 'A'-weighted instantaneous SPL in Pascals

We assume that the current L_{eq} equals $L_{Aeq,Te}$.

Thus, if, for example, T_e was 8 hours (28 800 seconds), $L_{EP,d}$ and $L_{Aeq,Te}$ would be the same, since $\log_{10} 1$ is zero.

If, however, T_e was 4 hours (14 400 seconds), and $L_{Aeq,Te}$ was 90 dB, the $L_{EP,d}$ would be 87 dB, as given by:

$$L_{EP,d} = 92.7 + 10 \log_{10} \frac{30\,600}{28\,800} = 90 - 3 = 87 \text{ dB}$$

The **EEC Directive ECC/86/188** states that where the daily personal noise exposure is likely to exceed 85 dB, certain measures should be taken. We outline these measures below. Please refer to the Directive itself if you need further information.

If the $L_{EP,d}$ exceeds **85 dB (A)**, then:

- workers and/or their representatives should be told of the potential hearing risks
- they should be told of any measures taken in accordance with Directive 86/188/EEC
- personal ear-protectors must be made available to workers

If $L_{EP,d}$ exceeds **90 dB (A)**, then:

- the reasons for excess levels should be identified, and the employer should, by whatever means, seek to reduce the exposure of workers to noise

- workers and their representatives should receive information on the measures taken by employers to reduce noise
- personal ear-protectors must be worn by workers

If measures to reduce the $L_{EP,d}$ below 85 dB (A) are not feasible, the Directive recommends that workers' hearing should be checked regularly by a doctor. Workers should have access to the results of these tests, as far as national law and practice allows.

E (Pa^2h)	$L_{EP,d}$ (dB)	E (Pa^2h)	$L_{EP,d}$ (dB)
0.32	80	6.39	93
0.40	81	8.04	94
0.51	82	10.12	95
0.64	83	12.74	96
0.80	84	16.04	97
1.01	85	20.19	98
1.27	86	25.42	99
1.60	87	32.00	100
2.02	88	40.29	101
2.54	89	50.72	102
3.20	90	63.85	103
4.03	91	80.38	104
5.07	92	101.19	105

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Table 11.1. The relationship between the Pa^2h and $L_{EP,d}$ parameters

Pa^2h (Pascal Squared Hours)

Pa^2h is a parameter recommended by **IEC Draft 29c** – "Personal Sound Exposure Meters."

The formula for calculating the **Pa^2h** is given below:

$$Pa^2h = \int_0^T P_A^2(t)\ dt$$

where,

P_A^2 is the square of instantaneous A-frequency weighted sound pressure as a function of time t for an integration time period equal to the actual measurement time.

Table 11.1 shows the relationship between Pascal Squared Hours (Pa^2h) values and the $L_{EP,d}$ (Daily Personal Noise Exposure). Note that 3.20 Pa^2h corresponds to 90 dB $L_{EP,d}$, and 32.00 Pa^2h corresponds to 100 dB $L_{EP,d}$.

11.4. PSEL (PERSONAL SOUND EXPOSURE LEVEL)

The **PSEL** is the L_{eq} normalized to a period of eight hours (compare it to the Sound Exposure level (SEL), which is the L_{eq} normalized to a period of one second).

The formula for calculating the **PSEL** is as follows:

$$\textbf{PSEL} = L_{Aeq,Te} + 10 \log_{10} \frac{T}{T_0}$$

where,

T = the actual measurement time
$\mathbf{T_0}$ = 8 h = 28800 seconds

Note: If the actual measurement time is the same as T_e, the **PSEL** and the $L_{EP,d}$ values will be the same.

12. APPENDICES

12.1. A DESCRIPTION OF THE INTERNAL MICROPHONE SYSTEM

Fig. 12.1 shows where the internal microphone is placed. The diaphragm of the microphone is positioned parallel to incoming sound signals, which are led to the microphone by the rubber tube. The internal microphone is a 1/4-inch permanently polarized condenser type with back electret and integral preamplifier.

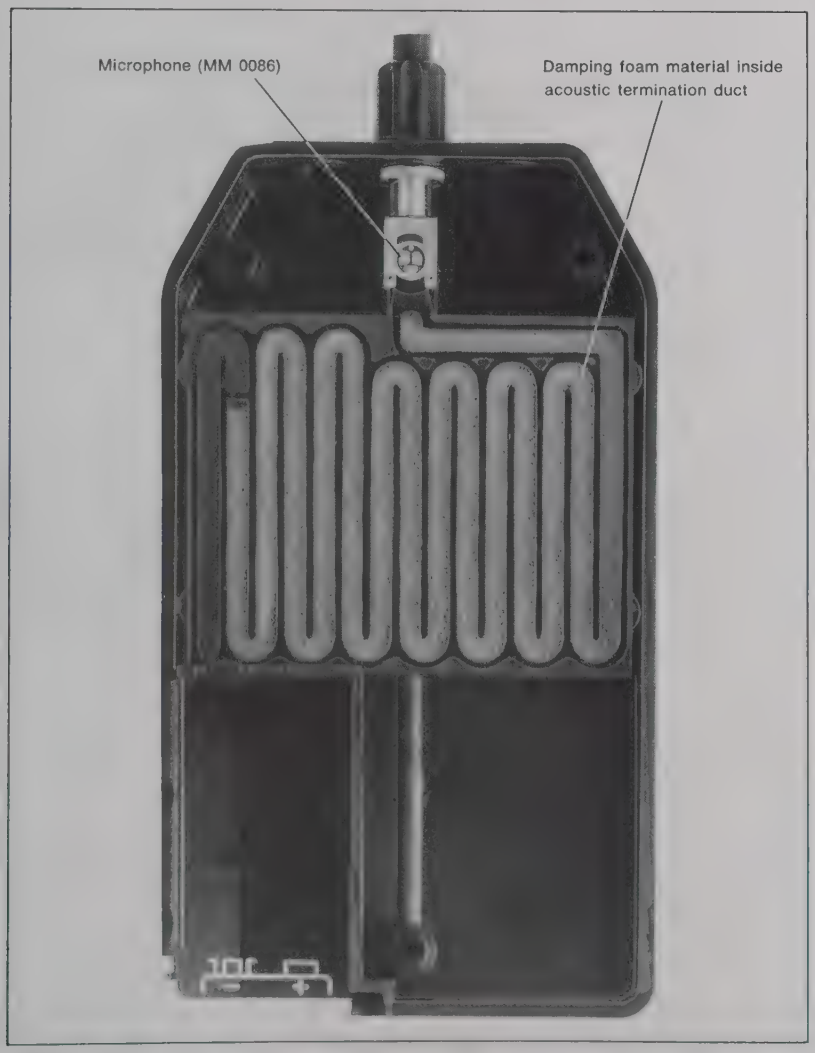

Fig. 12.1. The Type 4436's internal microphone and acoustic termination

Because the surface of the microphone diaphragm is parallel to the direction of the sound signals, distortion is avoided. Once the sound signals pass the microphone, they travel along a duct which is part of the Type 4436's cabinet moulding. This duct contains a damping foam material, which deadens the sound signals, thus avoiding standing waves.

The rubber tube is 70 cm long. It attenuates higher sound frequencies, and this is compensated for by the Type 4436's input filter. Thus, you should only use the supplied rubber tube. A spare rubber tube is supplied with the instrument.

12.2. HOW DOES THE TYPE 4436 TRANSFER DATA TO A COMPUTER?

In this section, we shall describe how the Type 4436 sends data to a computer. We shall deal with the three PC **Print** options in turn. To see how to use these options, see Chapter 9.

12.2.1. PC Transfer

How long does PC Transfer take, and what data is transferred?

In PC Transfer, the Type 4436 sends its measurement data in a form which a personal computer (with suitable communications software, like BK-LINK Version 2.0 or ProComm) can accept. The data is transferred in the following order, and takes the following times:

1. **Status** (instrument's measurement settings and results), whose transfer takes about 8 seconds.

2. **Distribution** (distribution of sound levels at 1 dB intervals), whose transfer takes about 30 seconds.

3. **History** (1-minute values for L_{eq} (or L_{av}), MaxL and MaxP), whose transfer takes about 25 seconds for every hour's worth of measurement data.

   For 8 hours' measurement data, PC Transfer would take about 4 minutes.

How is data transferred during PC Transfer?

1. When the Type 4436 is ready to send data to the computer, it waits for a "BREAK" signal from the computer.

2. When it receives this, the Type 4436 transmits <**CR**><**LF**>**$**, and then waits for another "BREAK" signal.

3. When it receives this, the Type 4436 sends out its data in ASCII format.

4. A "BREAK" signal may be used to stop the transfer of data.

12.2.2. PC DATA LOG

What data is transferred during PC DATA LOG?

In PC DATA LOG, the Type 4436 sends 1-second measurement values to a personal computer (with Type 7636 Application Software). The computer collects and processes this data. The 1-second measurement values appear in the following order:

1. $\mathbf{L_{eq}/L_{av}}$ (the mean value in dB(A), depending on the current Exchange Rate (q = 3, 4 or 5)).

2. **MaxL** (the maximum Sound Level in dB(A), depending on the current Time Weighting (Slow or Fast)).

3. **MaxP** (the maximum Peak value in dB, depending on the current filter (A or Lin.)).

How is data transferred during PC DATA LOG?

1. When the Type 4436 is ready to send data to the computer, it waits for a "BREAK" signal from the computer.

2. When it receives this, the Type 4436 transmits <**CR**><**LF**>**$**, and then waits for another "BREAK" signal.

3. When it receives this, the Type 4436 starts making its measurements. Measurement data comes after about 3 seconds, and thereafter at 1-second intervals. The data is in ASCII format.

4. A "BREAK" signal may be used to stop the transfer of data.

12.2.3. PC Dump

How long does PC Dump take, and what data is transferred?

In PC Dump, the Type 4436 sends all its measurement data very quickly to a personal computer (with BZ 7028 Application Software). The computer must then convert this data into a usable form. The initial transfer of data takes a couple of minutes.

How is data transferred during PC Dump?

1. When the Type 4436 is ready to send data to the computer, it waits for a "BREAK" signal from the computer.

2. When it receives this, the Type 4436 transmits <**CR**><**LF**>**$**, and then waits for another "BREAK" signal.

3. When it receives this, the Type 4436 sends out its data in ASCII format, with 16 bytes per line.

4. A "BREAK" signal may be used to stop the transfer of data.

5. After the last line of data has been sent, there comes an extra line with one HEX byte. This one byte denotes the sum of all those HEX bytes which were previously transmitted.

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(All entries in **bold** refer to Type 4436 pushkeys)

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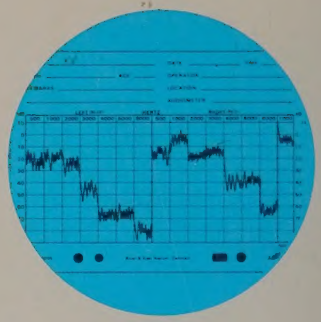

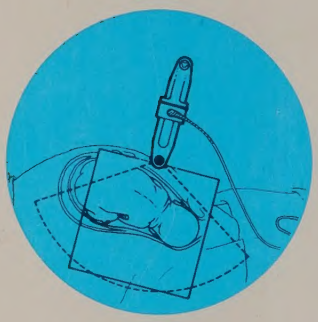

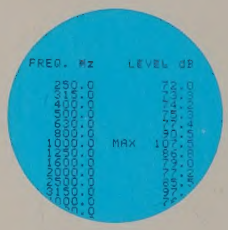

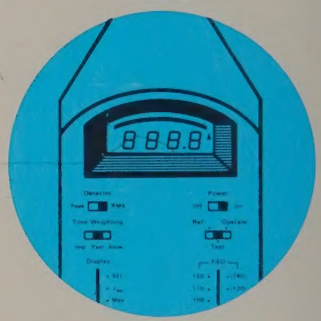

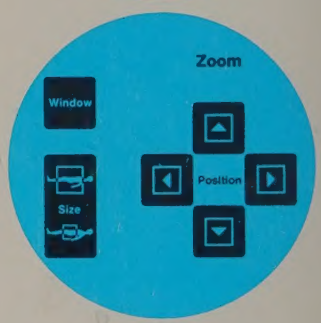

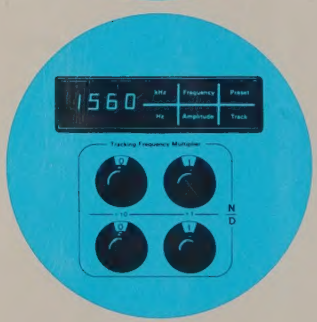

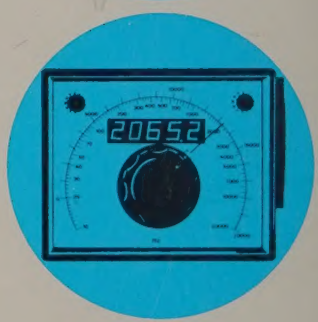

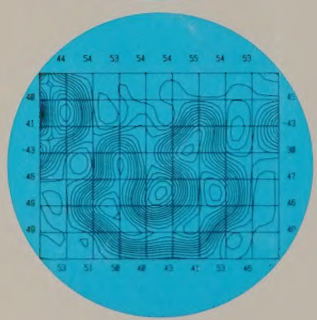

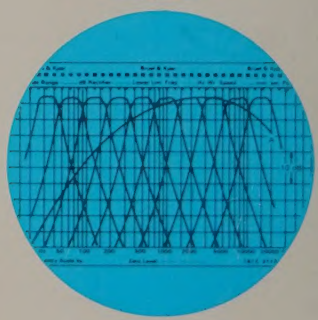

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